United States Department of Agriculture

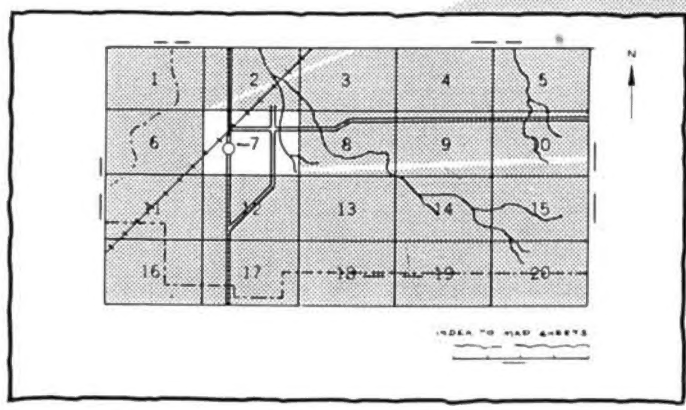
Soil Conservation Service

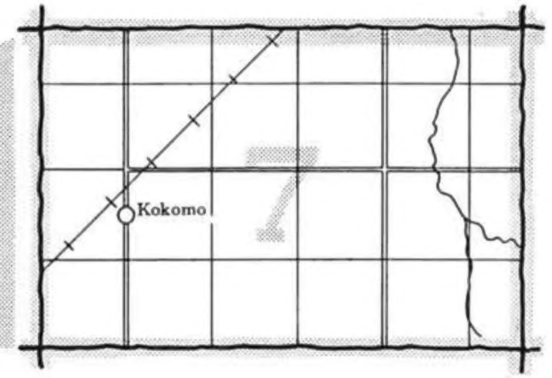
In cooperation with Purdue University Agricultural Experiment Station and Indiana Department of Natural Resources, Soil and Water Conservation Committee

Soil Survey of Ripley County and Part of Jennings County, Indiana

HOW TO USE THIS SOIL SURVEY

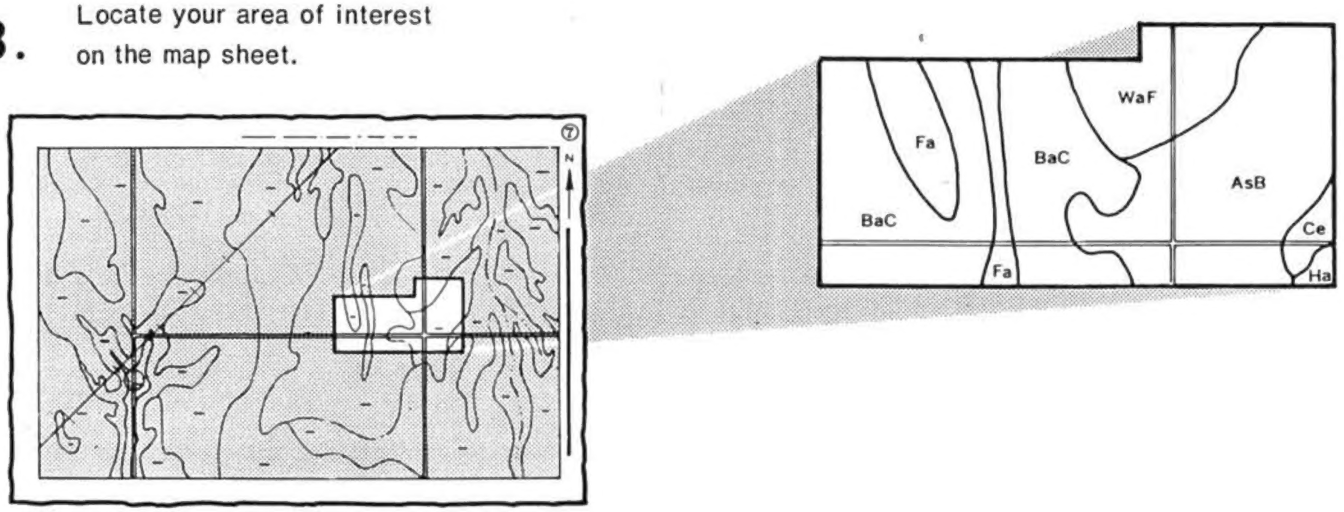
1. Locate your area of interest on the "Index to Map Sheets".



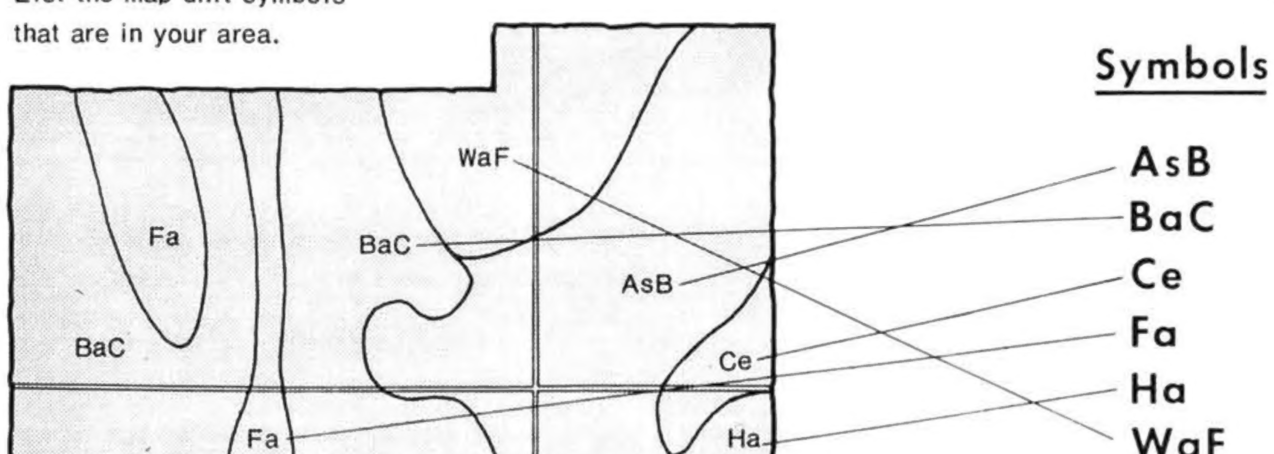


2. Note the number of the map sheet and turn to that sheet.

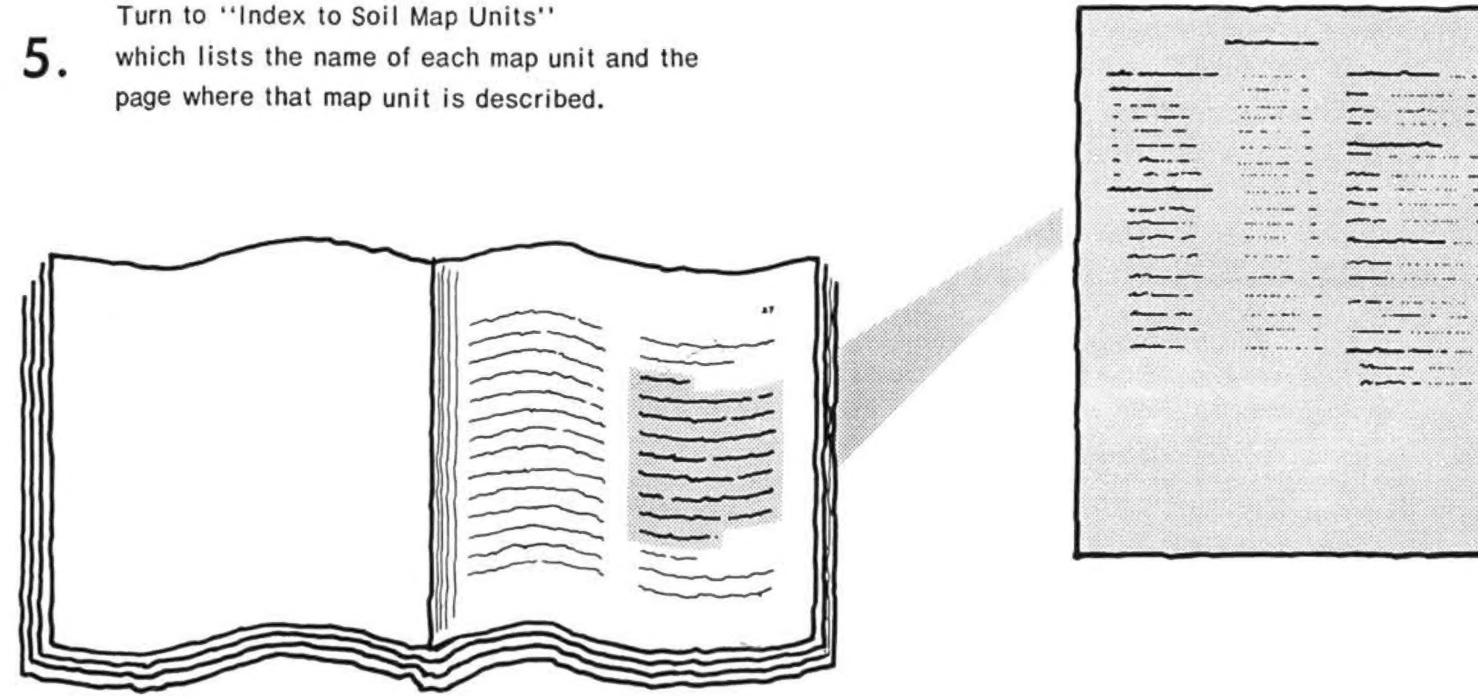
3. Locate your area of interest on the map sheet.



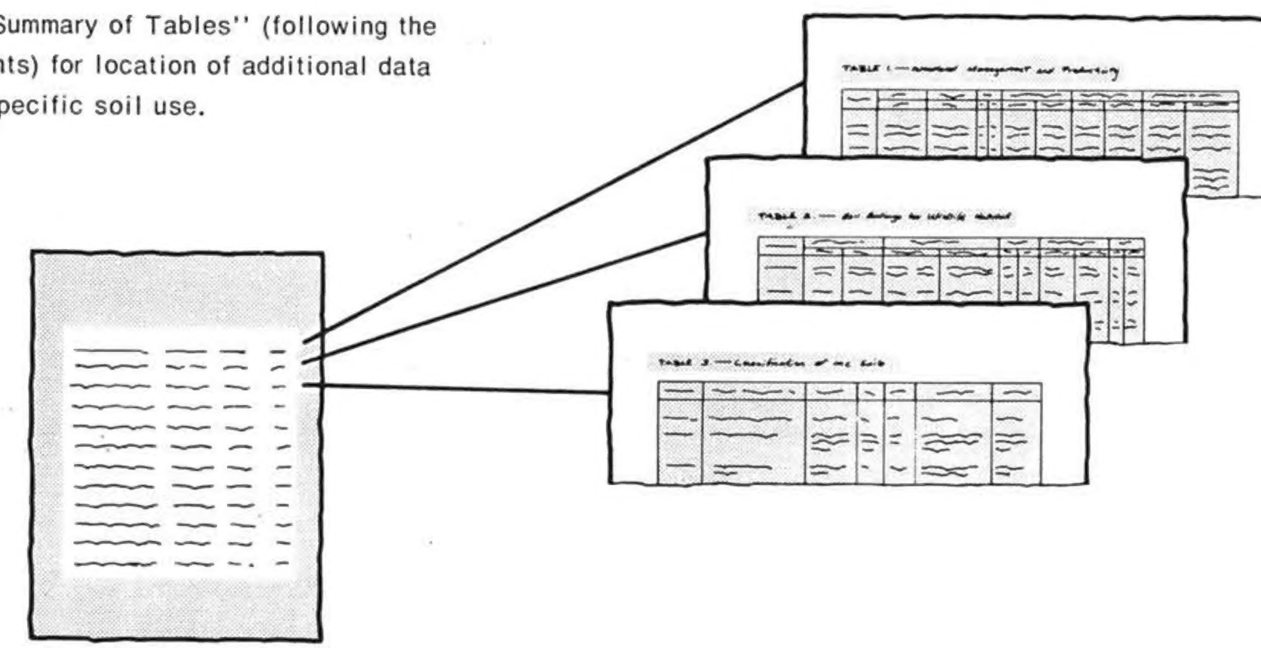
4. List the map unit symbols that are in your area.



5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service; the Purdue University Agricultural Experiment Station; and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Ripley County Soil and Water Conservation District and the Area Planning Commission. Financial assistance was made available by the Ripley County Commissioners and approved by the County Council.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Grass-legume hay on Avonburg silt loam, 0 to 2 percent slopes.

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Soil Series

Issued April 1985

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Summary of Tables

Foreword

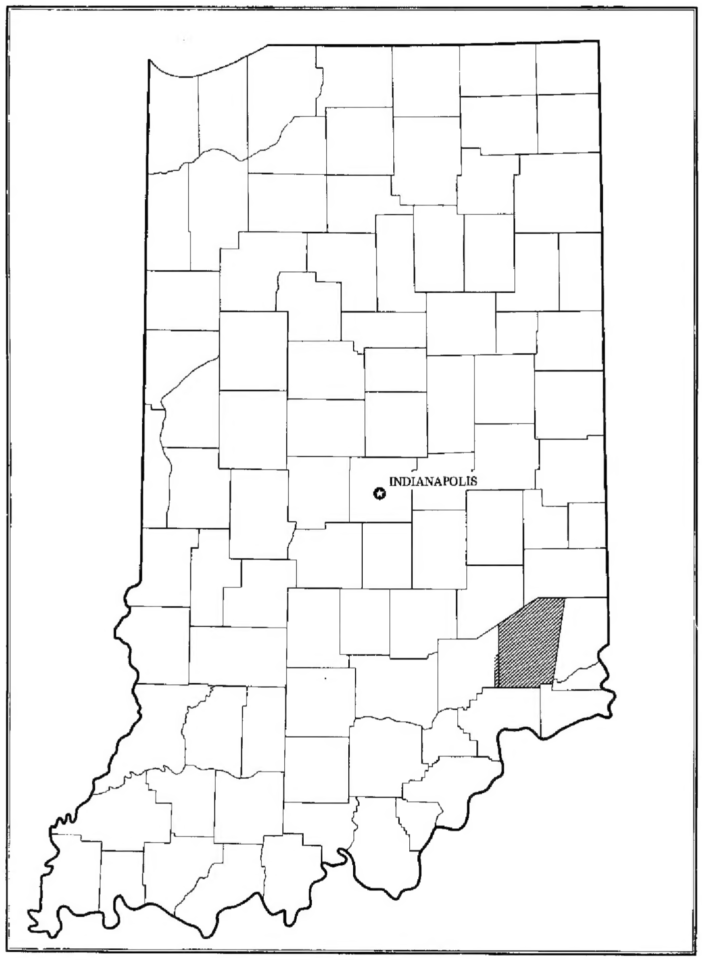
This soil survey contains information that can be used in land-planning programs in Ripley County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L. Eddleman
State Conservationist
Soil Conservation Service



Location of Ripley County and Part of Jennings County in Indiana.

Soil Survey of
Ripley County
and Part of Jennings County, Indiana

By Kendall M. McWilliams, Soil Conservation Service

Fieldwork by Kendall M. McWilliams, Soil Conservation Service, and Noel P. Anderson, Terry L. Stephenson, David Shadis, Dan Harkenrider, and Gregory Henderson, Indiana Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service, in cooperation with Purdue University Agricultural Experiment Station and Indiana Department of Natural Resources, Soil and Water Conservation Committee

This survey area is in southeastern Indiana. It is bordered on the north by Decatur and Franklin Counties, on the east by Dearborn and Ohio Counties, on the south by Jefferson and Switzerland Counties, and on the west by Jennings County. It has a land area of about 295,165 acres, or 461 square miles. About 5,905 acres is in the Versailles State Park, 27,084 acres is in the Jefferson Proving Ground in Ripley County, and 8,374 acres is in the Jefferson Proving Ground in Jennings County. The Jefferson Proving Ground is in federal ownership. The survey area is about 18 miles from east to west and 25 miles from north to south. Batesville, the largest city in the survey area, has a population of about 3,800. Versailles is the county seat of Ripley County. Businesses within the survey area employ a large part of the work force. About 36 percent of the work force is engaged in manufacturing and about 8 percent in farming (*5*).

The landscape of Ripley County is an upland consisting of broad flats, undulating plains, and steeper areas along streams and drainageways. Narrow bottom land is along the larger streams. The general direction of drainage is to the south. The highest point in Ripley County, about 1,060 feet above sea level, is about a mile north of Sunman. The lowest point, about 590 feet above sea level, is at the base of Laughery Creek at the Ripley-Dearborn County line.

About 67 percent of the county is farmland and 19 percent woodland (*3*). Cash grain production and general livestock production are the main farming enterprises in the county.

General Nature of the Survey Area

This section gives information about the general features that affect soil use in the survey area.

Water

Surface water is the main source of water in Ripley County. Batesville, Holton, Milan, and Versailles obtain their municipal water from reservoirs. Napoleon and Osgood obtain their water from a deep well. The southeastern part of the county participates in a rural water system, which obtains its water from a deep well in Switzerland County. Other towns and residences in Ripley County are dependent on ground water from individual wells.

Ground water in upland areas is of limited extent. Generally, the bedrock in the survey area does not have dependable water-bearing strata. Most of the wells are shallow, 20 to 40 feet deep, and are in glacial material of Illinoian age. The quantity of water from these wells varies, but the quality is generally good. There are numerous springs in the survey area, but few of them provide a dependable water supply of sufficient quality and quantity.

Transportation Facilities

Interstate Highway 74 extends for 9 miles across the northern part of the survey area. Also, there are about 47 miles of federal highways, 90 miles of state highways, and 875 miles of county roads. Most of the county roads are paved, and a few are graveled.

Two main railroad lines cross the survey area. The one in the northern part of the survey area serves Batesville, Morris, Spades, and Sunman. The other serves Holton, Osgood, and Milan. No passenger service is available.

There are no large airports in the survey area. The nearest large commercial airport is about 60 miles away, near Cincinnati, Ohio. Several private facilities for small planes are available in the survey area.

Trends in Population and Land Uses

In 1980, Ripley County had a population of about 24,481 and a population density of about 54 people per square mile. The population increased 16 percent between 1970 and 1980 and is expected to increase about 7 percent by the year 2000 *(4)*.

About 4 percent of the county is urbanized land, and the rest is agricultural land and woodland. Recent trends have been toward a moderate rate of conversion of agricultural land to urban uses. This trend is expected to continue.

History

Ripley County, organized in 1817, was named after General Eleazer Wheelock Ripley, who fought in the War of 1812 *(6)*. In 1814, Daniel and Henry Wooley settled in what is now Shelby Township. In May of 1818, at the home of Benjamin Brown near New Marion, the county was divided into three townships. In 1858, Center Township was organized in the last of a series of changes that resulted in the present 11 townships.

John de Paul, who owned a great deal of land in Ripley County, gave 100 acres to the county in 1818. This became Versailles, the county seat, which was named after the town in France where de Paul's father was born. On September 21, 1818, the first sale of lots in Versailles was held, and 166 lots were sold. The first courthouse was constructed in 1821 on the public square.

Napoleon was platted on February 9, 1820, and was the second town in the county. Cross Plains was platted in 1826, New Marion in 1832, Milan in 1836, Friendship in 1850, Batesville in 1852, and Sunman and Osgood in 1856.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The survey area is cold in winter and quite hot in summer. Winter precipitation, which frequently falls during snowstorms, results in a good accumulation of soil moisture by spring. The accumulated soil moisture minimizes drought during the summer on most soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and the length of the growing season.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Greensburg, Indiana, in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 31 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Greensburg on February 2, 1951, is -35 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 105 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 40 inches. Of this, 23 inches, or about 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 4.6 inches on January 21, 1959. Thunderstorms occur on about 50 days each year, and most occur in summer.

The average seasonal snowfall is about 17 inches. The greatest snow depth at any one time during the period of record was 11 inches. On the average, 11 days of the year have at least 1 inch of snow on the ground. The number of such days varies from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 11 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are local in extent and of

short duration, and the resulting damage varies from area to area.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, specialty crops, woodland, urban uses,* and *recreation areas.* Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness.

The names, descriptions, and delineations of the soils identified on the general soil map of this survey area do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. For example, the Cobbsfork soils in this survey were correlated as Clermont soils in earlier surveys. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Soil Descriptions

1. Cobbsfork-Avonburg

Deep, nearly level and gently sloping, poorly drained and somewhat poorly drained, medium textured soils formed in loess and silty glacial drift; on upland ridgetops

This map unit consists mainly of soils on broad ridges between drainageways. Areas are large and extend throughout the counties. Slopes range from 0 to 6 percent.

This map unit makes up about 45 percent of the survey area. It is about 61 percent Cobbsfork soils, 31 percent Avonburg soils, and 8 percent soils of minor extent (fig. 1).

Cobbsfork soils are poorly drained and are nearly level. They are on broad ridgetops. Typically, they have a dark grayish brown silt loam surface layer. The subsoil is light gray, mottled silt loam and silty clay loam in the upper part and gray, dark yellowish brown, and yellowish brown, mottled silt loam and silty clay loam in the lower part.

Avonburg soils are somewhat poorly drained. They are nearly level on ridgetops and gently sloping in areas near the head of drainageways. Typically, they have a dark grayish brown silt loam surface layer. The upper part of the subsoil is yellowish brown and light brownish gray, mottled silt loam. The lower part is a fragipan of light brownish gray, mottled silty clay loam and silt loam.

Minor in this map unit are the moderately well drained Rossmoyne soils and the well drained Cincinnati soils. Rossmoyne soils are on ridgetops and short breaks in the uplands, and Cincinnati soils are on ridgetops and hillsides in the uplands.

This map unit is used mainly for crops. Most of the acreage has been cleared, and some areas have been drained. Some wet, undrained areas are wooded. Wetness and erosion are the main limitations if the major soils are used for farming or for most other purposes.

This map unit has good potential for cultivated crops, but wetness is such a severe limitation that artificial drainage is needed. The potential for residential and other urban uses is poor. An adequate drainage system

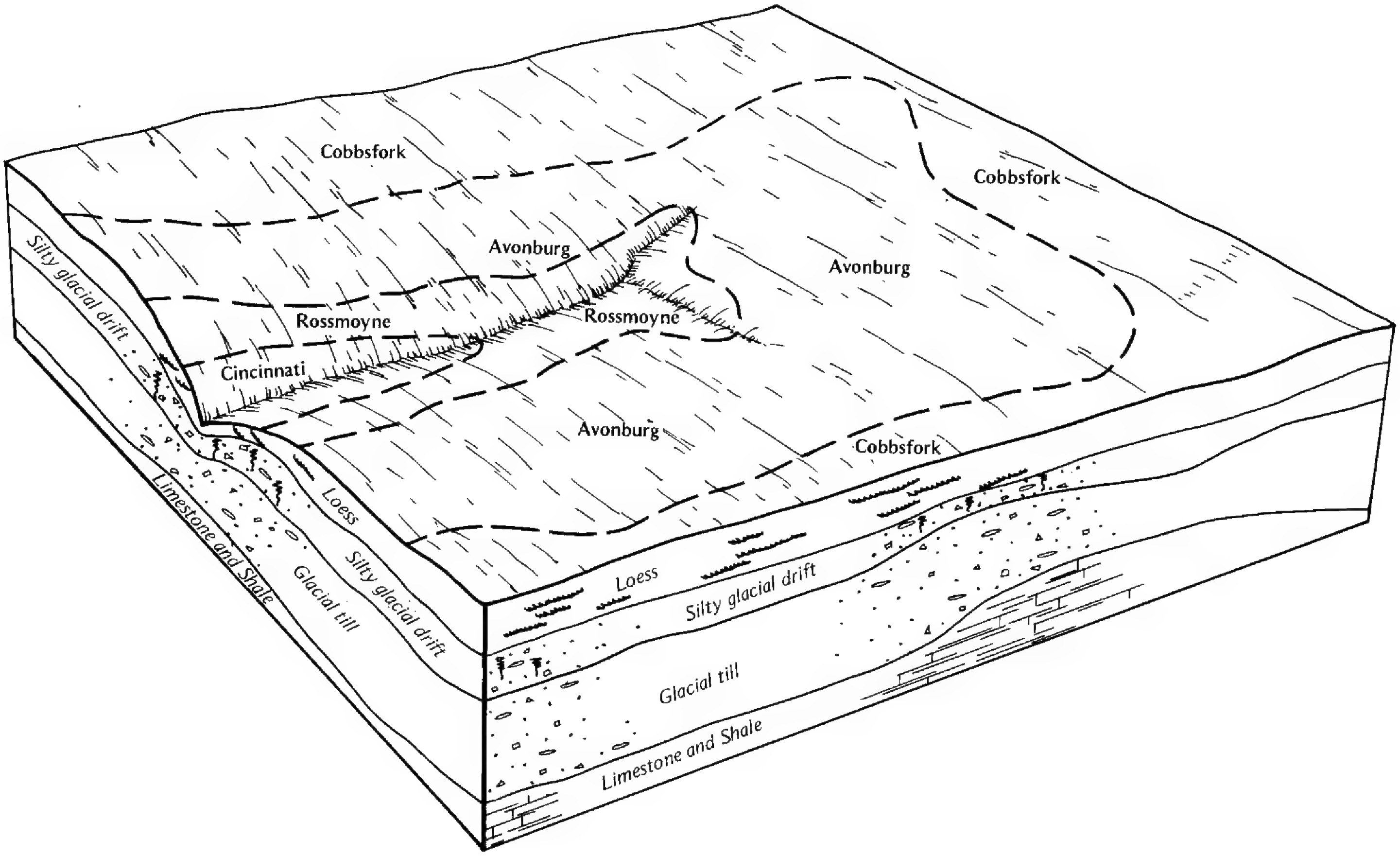


Figure 1.—Pattern of soils and parent material in the Cobbsfork-Avonburg map unit.

is needed if areas are used for urban development. The potential for woodland is good.

2. Cincinnati-Rossmoyne-Hickory

Deep, nearly level to steep, well drained and moderately well drained, medium textured soils formed in loess and in the underlying silty glacial drift or glacial till; on upland side slopes and ridgetops

This map unit is on ridges and side slopes along drainageways on the loess-covered Illinoian till plain. Areas are large and are scattered throughout the counties. Slopes range from 0 to 35 percent.

This map unit makes up about 45 percent of the survey area. It is about 32 percent Cincinnati soils, 27 percent Rossmoyne soils, 22 percent Hickory soils, and 19 percent soils of minor extent (fig. 2).

Cincinnati soils are well drained. They are gently sloping on narrow ridgetops and moderately sloping and strongly sloping on side slopes. Typically, they have a dark grayish brown silt loam surface layer. The upper part of the subsoil is yellowish brown silt loam and silty clay loam. The lower part is a fragipan of yellowish brown and strong brown, mottled silty clay loam, loam, and clay loam.

Rossmoyne soils are moderately well drained and are nearly level and gently sloping. They are on ridgetops. Typically, they have a brown silt loam surface layer. The upper part of the subsoil is light brownish yellow and yellowish brown, mottled silt loam. The lower part is a fragipan of light gray, mottled silt loam and silty clay loam.

Hickory soils are well drained and are strongly sloping to steep. They are on side slopes. Typically, they have a brown silt loam surface layer. The subsoil is yellowish brown, mottled silt loam and clay loam. The underlying material is yellowish brown, mottled clay loam.

Minor in this map unit are the well drained Bonnell, Haymond, and Wirt soils and the somewhat poorly drained Holton and Wakeland soils. Bonnell soils do not have a fragipan. They are on side slopes. Haymond, Holton, Wakeland, and Wirt soils are on bottom land that is subject to flooding.

This map unit is used mainly for crops and for hay and pasture. The more steeply sloping areas are used for

woodland. Erosion and slope are the main limitations if the major soils are used for farming or for most other purposes.

This map unit has good potential for hay and pasture and for woodland. The nearly level and gently sloping areas have good potential for cultivated crops. Because of the slope of the Cincinnati and Hickory soils and the slow permeability of the Cincinnati and Rossmoyne soils, the potential for residential and other urban uses is only fair.

3. Eden-Carmel-Switzerland

Moderately deep and deep, moderately sloping to very steep, well drained, medium textured and moderately fine textured soils formed in shale and limestone residuum or in loess and the underlying residuum; on upland side slopes

This map unit is on side slopes along the larger streams. Slopes range from 6 to 50 percent.

This map unit makes up about 10 percent of the survey area. It is about 46 percent Eden soils, 15 percent Carmel soils, 13 percent Switzerland soils, and 26 percent soils of minor extent (fig. 3).

Eden soils are moderately deep and are moderately steep to very steep. They are on slopes along the major drainageways. Typically, they have a very dark grayish brown flaggy silty clay loam surface layer. The subsoil is yellowish brown and dark yellowish brown flaggy silty clay in the upper part and olive yellow, mottled flaggy silty clay loam in the lower part. Weathered shale and limestone are at a depth of about 40 inches.

Carmel soils are deep and are strongly sloping to steep. They are on side slopes. Typically, they have a dark grayish brown silt loam surface layer. The subsoil is yellowish brown silt loam in the upper part and yellowish brown clay in the lower part. The underlying material is yellowish brown, mottled silty clay. Weathered shale and limestone are at a depth of about 53 inches.

Switzerland soils are deep and are moderately sloping and strongly sloping. They are on side slopes and ridgetops. Typically, they have a brown silt loam surface layer. The subsoil is yellowish brown silt loam and silty clay loam in the upper part and yellowish brown silty clay in the lower part. Weathered shale and limestone are at a depth of about 64 inches.

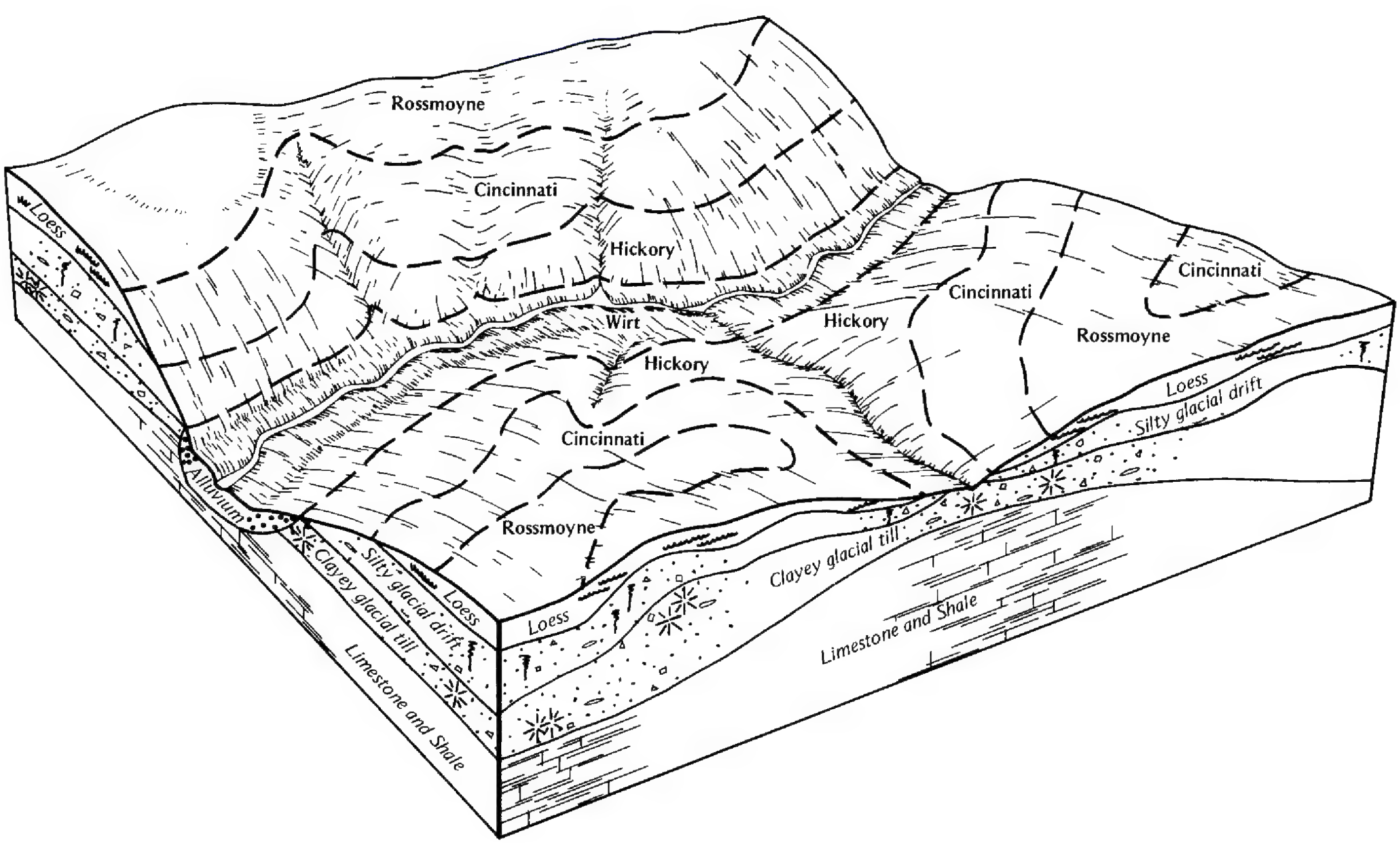


Figure 2.—Pattern of soils and parent material in the Cincinnati-Rossmoyne-Hickory map unit.

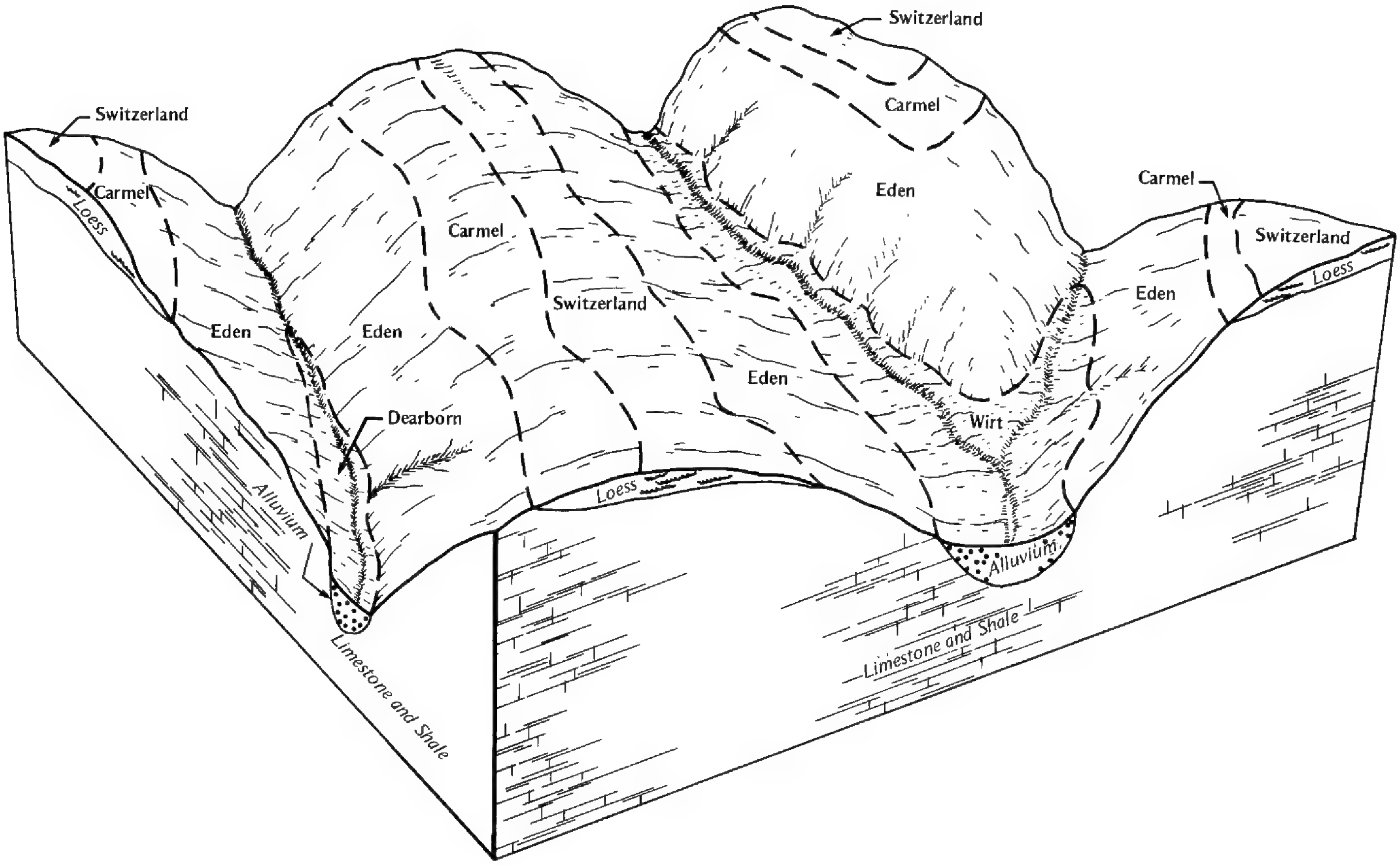


Figure 3.—Pattern of soils and parent material in the Eden-Carmel-Switzerland map unit.

Minor in this map unit are the deep, moderately permeable Elkinsville and moderately well drained Pekin soils on stream terraces and Dearborn, Nolin, and Wirt soils on bottom land that is subject to flooding.

This map unit is used mainly for woodland. The less sloping areas are used for pasture and crops. Slope and erosion are the main limitations affecting most uses.

This map unit has good potential for woodland. The less sloping areas have fair potential for crops and good potential for hay and pasture. The steeper areas have poor potential for crops and for urban development because of the slope and the erosion hazard.

Broad Land Use Considerations

Determining the long-term use of the land in the survey area is an important issue. Each year a substantial amount of land is developed for urban uses near the larger towns and in scattered areas. This expansion of urban areas removes agricultural land from production. Providing and maintaining government services is difficult because of the scattered development of these areas. The general soil map is helpful in planning the general outline of urban areas but cannot be used for the selection of sites for specific urban structures. The data about specific soils in the survey area can be helpful in planning land use patterns.

Areas where the soils are so unfavorable that urban development is prohibited are not extensive. In most areas, however, special treatment is needed to overcome limitations or hazards. The major soils in the Cobbsfork-Avonburg map unit have a seasonal high water table. Lowering the water table sufficiently for extensive urban development is costly.

The slopes in the Eden-Carmel-Switzerland map unit and the steeper areas in the Cincinnati-Rossmoyne-Hickory map unit limit urban development. They hinder the use of machinery and increase the hazard of erosion during construction. In many places the soils in the Eden-Carmel-Switzerland map unit are moderately deep to bedrock and have a clayey subsoil. As a result, the cost of construction for structures requiring excavation is greatly increased.

Some soils throughout the survey area can be developed for urban uses at a lower cost than others. These include the less sloping soils in the Cincinnati-Rossmoyne-Hickory map unit. Special measures are needed, however, if these soils are used as sites for sanitary facilities.

In many areas the soils have good potential for crops but poor potential for urban uses. The major soils in the Cobbsfork-Avonburg map unit, for example, are wet during parts of the year. This limitation generally is not severe during most of the cropping season.

Soils that are well suited to specialty crops are not extensive in the survey area. Some of the soils in the Cincinnati-Rossmoyne-Hickory map unit have fair potential for some specialty crops, such as apples.

All of the map units in the survey area have good potential for woodland. Stands of commercially valuable trees are common throughout the survey area, especially on the steeper soils in the Cincinnati-Rossmoyne-Hickory map unit.

Most of the map units in the survey area have good potential for parks and recreation areas and for wildlife habitat. The potential of the Eden-Carmel-Switzerland map unit is especially good. Natural hardwood forests enhance the beauty of this map unit and provide habitat for many species of wildlife.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Cincinnati silt loam, 2 to 6 percent slopes, eroded, is one of several phases in the Cincinnati series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Eden-Rock outcrop complex, 25 to 50 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, Quarry, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this survey area do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. For example, the Cobbsfork soils in this survey were correlated as Clermont soils in earlier surveys. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ag—Algiers silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land along small streams. It is frequently flooded for very brief periods in winter and early in spring. Areas are elongated and follow the stream channels. They are 5 to 30 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The recently deposited underlying material is grayish brown, mottled silt loam about 22 inches thick. An older buried soil is at a depth of about 30 inches. It has a very dark gray loam surface layer about 11 inches thick. The buried subsoil is very dark grayish brown, mottled, firm loam about 6 inches thick. The buried underlying material to a depth of about 80 inches is dark gray and grayish brown, mottled loam. In places the recently deposited material is less than 20 inches thick.

Included with this soil in mapping are small areas of the more sandy Holton soils, the more silty Wakeland

soils, and the moderately well drained Lobdell soils. These soils are near stream channels and on small alluvial fans. Also included are small areas of poorly drained soils in depressions and old channels. Included soils make up about 15 percent of the map unit.

Available water capacity is high in the Algiers soil, and permeability is moderate. The organic matter content is moderate in the surface layer. Surface runoff is slow. The surface layer is neutral. A seasonal high water table is at a depth of 1 to 2 feet in winter and early in spring.

Most areas are used as cropland. Many are used for pasture or hay. Some are used as woodland.

This soil is well suited to cropland. Corn and soybeans are the most common crops. The soil is better suited to these crops than to winter wheat because it is frequently flooded in winter and early in spring. The wetness also is a limitation. Subsurface drains, open ditches, or surface drains remove excess water. Cover crops and crop residue management improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is better suited to grasses than to deep-rooted legumes because of the seasonal high water table. Artificial drainage is needed. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by cutting, spraying, or girdling.

Because the wetness and the flooding are severe limitations, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding, low strength, and frost action. Building the roads on raised, well compacted fill material helps to prevent the damage caused by flooding. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

The land capability classification is IIw. The woodland ordination symbol is 2a.

AvA—Avonburg silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on uplands. Areas are irregularly shaped and are 3 to 200 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The upper part of the subsoil is yellowish brown and light brownish gray, mottled, friable silt loam about 17 inches thick. The lower part to a depth of about 80 inches is a fragipan of light brownish gray, mottled, firm and very firm silty clay loam and silt loam. In places the slope is more than 2 percent.

Included with this soil in mapping are a few small areas of the poorly drained Cobbsfork soils on broad uplands and some small areas of the moderately well drained Rossmoyne soils on narrow ridgetops. Included soils make up about 5 percent of the map unit.

Available water capacity is moderate in the Avonburg soil, and permeability is very slow. The organic matter content is low in the surface layer. Surface runoff is slow. The surface layer is medium acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth. A perched seasonal high water table is at a depth of 1 to 3 feet in winter and early in spring.

Most areas are used as cropland. Some are used for hay and pasture. A few are used as woodland.

This soil is well suited to cropland. The most common crops are corn, soybeans, and winter wheat. A small acreage is used for tobacco. Wetness is the main limitation. Surface drains help to remove excess water. A subsurface drainage system generally is not satisfactory because the tile must be installed in the very slowly permeable fragipan before the proper depth can be obtained. During years when rainfall is below normal, crop yields are reduced because of a lack of sufficient moisture. The fragipan limits the depth of root penetration. A conservation tillage system that leaves all or part of the crop residue on the surface and cover crops improve tilth and the available water capacity and increase the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is better suited to grasses than to deep-rooted legumes because of the seasonal high water table. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. The species selected for planting should be those that can withstand the seasonal wetness. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. A properly designed perimeter drainage system is needed to remove the water perched on the fragipan. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the very slow permeability and the wetness, this soil is severely limited as a septic tank

absorption field. A specially designed disposal system or a public or commercial sewer system generally is needed.

The land capability classification is IIw. The woodland ordination symbol is 3d.

AvB2—Avonburg silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, somewhat poorly drained soil is on uplands. Areas are irregularly shaped and are 3 to 40 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is light gray, mottled silt loam about 6 inches thick. The upper part of the subsoil is light gray, mottled, friable silt loam about 14 inches thick. The lower part to a depth of about 80 inches is a fragipan of light gray, mottled, very firm silt loam; gray, mottled, very firm silt loam; and gray, mottled, firm silt loam. In places the lower part of the fragipan is slightly acid or neutral. In some areas the slope is less than 2 percent.

Included with this soil in mapping are a few small areas of the poorly drained Cobbsfork soils on broad uplands and some small areas of the moderately well drained Rossmoyne soils on narrow ridgetops. Included soils make up about 10 percent of the map unit.

Available water capacity is moderate in the Avonburg soil, and permeability is very slow. The organic matter content is low in the surface layer. Surface runoff is rapid. The surface layer is medium acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth. A perched seasonal high water table is at a depth of 1 to 3 feet in winter and early in spring.

Most areas are used as cropland. Some are used for hay and pasture. A few are used as woodland.

This soil is well suited to cropland. The most common crops are corn, soybeans, and winter wheat. Erosion is the main hazard. Measures that help to control erosion and surface runoff are the main management needs. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures may be needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is better suited to grasses than to deep-rooted legumes because of the seasonal high water table. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. The species selected for planting should be those that can withstand the seasonal wetness. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. A properly designed perimeter drainage system is needed to remove the water perched on the fragipan. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the very slow permeability and the wetness, this soil is severely limited as a septic tank absorption field. A specially designed disposal system or a public or commercial sewer system generally is needed.

The land capability classification is IIe. The woodland ordination symbol is 3d.

BaA—Bartle silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on low stream terraces. Areas are irregular in shape and are 3 to 15 acres in size. The dominant size is about 5 acres.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 47 inches. The upper part is yellowish brown and light brownish gray, mottled, friable silt loam; the next part is grayish brown, mottled, very firm, dense silty clay loam; and the lower part is grayish brown, mottled, firm silty clay loam. The underlying material extends to a depth of about 80 inches. It is gray, mottled, firm loam in the upper part and yellowish brown, mottled, stratified silt loam, loam, sand, and clay loam in the lower part. In some areas the soil has a thin subsurface layer. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Elkinsville and moderately well drained Pekin soils near the edges of the stream terraces. Also included are small areas of poorly drained soils in depressions. Included areas make up about 10 percent of the map unit.

Available water capacity is moderate in the Bartle soil, and permeability is very slow. The organic matter content is low in the surface layer. Surface runoff is slow. The surface layer is strongly acid unless limed. The very firm, dense layer in the subsoil limits rooting depth. A perched seasonal high water table is at a depth of 1 to 2 feet in winter and early in spring.

Most areas are used as cropland. Some are used for hay and pasture. A few are used as woodland.

This soil is well suited to cropland. Corn and soybeans are the most common crops. The wetness is the main limitation. Surface drains help to remove excess water. A subsurface drainage system generally is not satisfactory because the tile must be installed in the very slowly permeable, very firm, dense layer in the subsoil before the proper depth can be obtained. This layer limits the depth of root penetration. During years when rainfall is below normal, crop yields may be lower because of a lack of moisture. A conservation tillage system that leaves all or part of the crop residue on the surface improves tilth and the available water capacity and helps to maintain the organic matter content.

This soil is well suited to most grasses and legumes for hay or pasture. It is not well suited to deep-rooted grasses and legumes, however, because of the wetness. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. A properly designed perimeter drainage system is needed to remove the water perched on the dense layer in the subsoil. The soil is severely limited as a site for local roads and streets because of frost action. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by frost action.

Because of the very slow permeability and the wetness, this soil is severely limited as a septic tank absorption field. An alternative waste disposal system or a public or commercial sewer system is needed.

The land capability classification is IIw. The woodland ordination symbol is 3a.

BeC2—Bonnell silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and are 3 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 60 inches thick. The upper part is yellowish brown, friable and firm silt loam. The next part is brown and strong brown, firm clay. The lower part is brown, very firm clay loam. The underlying material to a depth of about 80 inches is yellowish brown, very firm clay loam. In some areas the silty clay loam or clay in the subsoil is exposed. In other areas the slope is more than 12 percent. In places the subsoil is less clayey.

Included with this soil in mapping are small areas of Cincinnati soils on narrow ridgetops. These soils have a fragipan. Also included are small areas of severely eroded soils. Included soils make up about 10 percent of the map unit.

Available water capacity is moderate in the Bonnell soil, and permeability is slow. The organic matter content is moderately low in the surface layer. Surface runoff is rapid. The surface layer is slightly acid or medium acid unless limed.

Most areas are used as pasture or woodland. A few are used as cropland.

This soil is suited to cropland. The most common crops are corn, soybeans, and winter wheat. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. The equipment limitation and plant competition are the main management concerns. The trees should be harvested only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Adequately reinforcing foundations and concrete structures, backfilling with a more stable base material, such as sand or gravel, and installing drains around footings help to prevent the structural damage caused by shrinking and swelling. Measures that help to control erosion during construction are needed. The soil is severely limited as a site for local roads and streets because of low strength and the shrink-swell potential. Establishing adequate road ditches and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and by shrinking and swelling.

Because of the slow permeability, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IIIe. The woodland ordination symbol is 2c.

BeD3—Bonnell silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and are 3 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is yellowish brown, firm clay loam in the upper part and strong brown and yellowish brown, firm silty clay loam in the lower part. The underlying material to a depth of about 80 inches is yellowish brown silty clay loam. In places the silty clay loam or clay loam in the subsoil is exposed. In some areas the slope is less than 12 percent or more than 18 percent. In other areas the subsoil is less clayey.

Included with this soil in mapping are small areas of Cincinnati soils. These soils have a fragipan. They are in positions on the landscape similar to those of the Bonnell soil. Also included are small areas of alluvium along small drainageways and small areas of uneroded or moderately eroded soils. Included soils make up about 10 percent of the map unit.

Available water capacity is moderate in the Bonnell soil, and permeability is slow. The organic matter content is low in the surface layer. Surface runoff is very rapid. The surface layer is medium acid or slightly acid unless limed. It tends to be sticky and cloddy unless it is tilled within a narrow range of moisture conditions.

Most areas are used as cropland. Some are used for hay and pasture. A few are used as woodland.

This soil generally is unsuited to cultivated crops because of the strong slopes and a severe erosion hazard. Small grain can be grown to reestablish stands of grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely defermemt of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is suited to trees. Erosion, the equipment limitation, seedling mortality, and plant competition are the main management concerns. The trees should be harvested only during dry periods or when the ground is frozen. Special machinery may be needed to improve the efficiency of harvesting. Logging roads should be built on the contour. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is severely limited as a site for dwellings. Adequately reinforcing foundations and concrete structures, backfilling with a more stable base material, such as sand or gravel, and installing drains around footings help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The surface should be disturbed as little as possible, and vegetation should be reestablished in the disturbed areas as soon as possible.

Because of low strength, the slope, and the shrink-swell potential, this soil is severely limited as a site for local roads and streets. The roads and streets should be designed so that they conform to the natural slope of the land as much as possible. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and by shrinking and swelling.

Because of the slow permeability and the slope, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is VIe. The woodland ordination symbol is 3r.

BeE—Bonnell silt loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and are 10 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil extends to a depth of about 80 inches. The upper part is yellowish brown, friable silt loam; the next part is strong brown, firm clay loam; and the lower part is yellowish brown, mottled, firm clay. In some places grayish mottles are within a depth of 20 inches. In other places free carbonates are within a depth of 40 inches. In some of the steeper areas, bedrock is within a depth of about 40 inches. In some areas the slope is less than 18 percent. In other areas the subsoil is less clayey.

Included with this soil in mapping are small areas of Cincinnati soils on toe slopes. These soils have a fragipan. Also included are small areas of severely eroded soils. Included soils make up about 10 percent of the map unit.

Available water capacity is moderate in the Bonnell soil, and permeability is slow. The organic matter content is low in the surface layer. Surface runoff is very rapid. The surface layer is medium acid or slightly acid unless limed.

Most areas are used for pasture. Many are used as woodland. Some of the less sloping areas are used for hay.

This soil generally is unsuited to cultivation because of a severe hazard of erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished. The slope limits the use of farm

machinery and the application of measures that help to control erosion.

This soil is suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. The slope hinders the use of farm machinery. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Erosion, the equipment limitation, and plant competition are the main management concerns. The trees should be harvested only during dry periods or when the ground is frozen. Special machinery may be needed to improve the efficiency of harvesting. Clear cutting should be avoided. Logging roads should be built on the contour as much as possible. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Mainly because the slope is a severe limitation, this soil generally is unsuitable as a site for dwellings, local roads and streets, and septic tank absorption fields. The moderately steep and steep slope limits the use of construction equipment. Special design, specific site information, and special construction practices are needed.

The land capability classification is VIe. The woodland ordination symbol is 2r.

CbD2—Carmel silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on uplands. Areas are irregularly shaped and are 5 to 30 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of about 40 inches. It is yellowish brown, friable silt loam in the upper part and yellowish brown, firm clay in the lower part. The underlying material to a depth of about 53 inches is yellowish brown silty clay. Weathered shale and limestone are at a depth of about 53 inches. In places the depth to shale and limestone is less than 40 inches. In some areas the slope is less than 12 percent.

Included with this soil in mapping are small areas of Hickory and Switzerland soils. These soils are on the upper part of the slopes. They contain less clay in the subsoil than the Carmel soil. Also included are small areas of alluvium along drainageways, small severely eroded areas, small areas of rock outcrops, and flaggy spots. Included areas make up about 10 percent of the map unit.

Available water capacity is moderate in the Carmel soil, and permeability is very slow. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer generally is medium acid or strongly acid unless limed.

Most areas are used for pasture or hay. Many are used as woodland. A few are used as cropland.

This soil is suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is severely limited as a site for dwellings. Adequately reinforcing foundations and concrete structures, backfilling with a more stable base material, such as sand or gravel, and installing drains around footings help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land.

Because of low strength, the slope, and the shrink-swell potential, this soil is severely limited as a site for local roads and streets. The roads and streets should be designed so that they conform to the natural slope of the land as much as possible. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and by shrinking and swelling.

Because of the very slow permeability and the slope, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IVe. The woodland ordination symbol is 1c.

CbE—Carmel silt loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and range from 3 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil extends to a depth of about 47 inches. It is yellowish brown, firm silty clay loam in the upper part; strong brown, firm silty clay in the next part; and yellowish brown, firm silty clay in the lower part. Soft, calcareous shale and limestone are at a depth of about 47 inches. In some places the silty clay loam or silty clay in the subsoil is exposed. In other places the depth to limestone and shale bedrock is less than 40 inches. In some areas the slope is less than 18 percent.

Included with this soil in mapping are small areas of the moderately deep Eden soils on the lower part of some side slopes. Also included are small areas of rock outcrops, escarpments, and sinkholes and narrow alluvial areas along small drainageways. Included areas make up about 10 percent of the map unit.

Available water capacity is moderate in the Carmel soil, and permeability is very slow. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer generally is medium acid unless limed.

Most areas are used as woodland. A few have been cleared and are used for pasture.

This soil generally is unsuited to cultivation because of the slope and a severe erosion hazard. The slope prevents the application of measures that help to control erosion on cropland.

This soil is suited to grasses and legumes for pasture. The slope limits the use of equipment needed for harvesting hay. Special management is needed to establish and maintain stands of desirable grasses and legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Erosion, the equipment limitation, seedling mortality, windthrow, and plant competition are the main management concerns. Logging roads and skid trails should be built on the contour. The trees should be logged only during dry periods. Clear cutting should be avoided. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by cutting, spraying, or girdling.

Mainly because the slope is a severe limitation, this soil generally is unsuitable as a site for dwellings, septic tank absorption fields, and local roads and streets. The moderately steep and steep slope severely limits the use of construction equipment. Special design, specific site information, and special construction practices are needed.

The land capability classification is VIe. The woodland ordination symbol is 1r.

CcB2—Cincinnati silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on narrow ridgetops in the uplands. Areas generally are long and narrow and are 5 to 40 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown, firm silt loam about 12 inches thick. The lower part to a depth of about 80 inches is a fragipan of strong brown, yellowish brown, and gray, mottled, very firm silt loam. In places grayish mottles are above the fragipan. In some areas the soil is uneroded, and in other areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Avonburg soils on the wider ridgetops and small areas of Bonnell and Hickory soils on side slopes. Bonnell and Hickory soils do not have a fragipan. Also included are small areas of severely eroded soils. Included soils make up about 5 percent of the map unit.

Available water capacity is moderate in the Cincinnati soil, and permeability is slow. The organic matter content is moderate in the surface layer. Surface runoff is rapid. The surface layer is strongly acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth.

Most of the acreage is cropland. Some areas are used for pasture and hay or for woodland.

This soil is well suited to cropland. The most common crops are corn, soybeans, small grain, and tobacco. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings without basements. It is moderately limited as a site for dwellings with basements because of the wetness. Basement

walls should be properly sealed, and foundation drains should be installed. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the slow permeability, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IIe. The woodland ordination symbol is 2d.

CcC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on side slopes in the uplands. Areas are long and narrow or oblong and range from 3 to 50 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The upper part of the subsoil is about 18 inches of yellowish brown, firm silt loam and silty clay loam. The next part to a depth of about 65 inches is a fragipan of yellowish brown, mottled, very firm silty clay loam, loam, and clay loam. The part of the subsoil below the fragipan extends to a depth of about 80 inches. It is strong brown, mottled, firm clay loam. In some small areas mottles are in the part of the subsoil above the fragipan. In other small areas the slope is less than 6 or more than 12 percent. In places the fragipan is silt loam and extends to a greater depth.

Included with this soil in mapping are small areas of Hickory and Bonnell soils on nose slopes. These soils do not have a fragipan. Also included are areas of severely eroded soils and areas of uneroded soils. Included soils make up about 5 percent of the map unit.

Available water capacity is moderate in the Cincinnati soil, and permeability is slow. The organic matter content is moderately low in the surface layer. Surface runoff is rapid. The surface layer is strongly acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth.

Most areas are used for pasture or hay. Some are used as cropland or woodland.

This soil is suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. The species selected for planting should be those that can withstand the seasonal wetness. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings without basements. It is moderately limited as a site for dwellings with basements because of the wetness and the slope. The dwellings should be designed so that they conform to the natural slope of the land. The surface should be disturbed as little as possible, and vegetation should be established in the disturbed areas as soon as possible. If dwellings with basements are built on this soil, the basement walls should be properly sealed and foundation drains should be installed. The soil is severely limited as a site for local roads and streets because of low strength and frost action. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the slow permeability, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IIIe. The woodland ordination symbol is 2d.

CcC3—Cincinnati silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on side slopes in the uplands. Areas are long and narrow or oblong and are 3 to 50 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is yellowish brown silt loam about 7 inches thick. The upper part of the subsoil is light yellowish brown, mottled, friable silt loam about 3 inches thick. The next part to a depth of about 29 inches is a fragipan of mottled yellowish brown and gray, firm silty clay loam. The part of the subsoil below the fragipan extends to a depth of about 80 inches. It is, in sequence downward, yellowish brown, mottled firm silty clay loam; mottled light olive gray and yellowish brown, firm clay; and dark yellowish brown, mottled, firm clay. In places the fragipan is at the surface. In some small areas the slope is more than 12 or less than 6 percent.

Included with this soil in mapping are small areas of Bonnell and Hickory soils on nose slopes. These soils do not have a fragipan. Also included are small areas of alluvium along drainageways and areas of uneroded or moderately eroded soils. Included areas make up about 10 percent of the map unit.

Available water capacity is moderate in the Cincinnati soil, and permeability is slow. The organic matter content is low in the surface layer. Surface runoff is rapid. The surface layer is strongly acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth.

Most of the acreage is cropland. A few areas are used for hay and pasture or for woodland.

This soil is poorly suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. The species selected for planting should be those that can withstand the seasonal wetness. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings without basements. It is moderately limited as a site for dwellings with basements because of the wetness and the slope. The dwellings should be designed so that they conform to the natural slope of the land. The surface should be disturbed as little as possible, and vegetation should be established in the disturbed areas as soon as possible. If dwellings with basements are built on this soil, the basement walls should be properly sealed and foundation drains should be installed. The soil is severely limited as a site for local roads and streets because of low strength and frost action. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the slow permeability, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IVe. The woodland ordination symbol is 2d.

CcD2—Cincinnati silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on side slopes in the uplands. Areas are long and narrow or oblong and are 3 to 35 acres in size. The dominant size is about 7 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The upper part of the subsoil is yellowish brown, friable silt loam about 18 inches thick. The next part to a depth of about 44 inches is a fragipan of strong brown, mottled, very firm loam and brown, mottled, very firm clay loam. The part of the subsoil below the fragipan extends to a depth of about 80 inches. It is dark brown and strong brown, mottled, very firm clay loam over dark yellowish brown, mottled, firm clay loam. In some small areas the slope is less than 12 percent.

Included with this soil in mapping are small areas of Bonnell and Hickory soils on toe slopes. These soils do not have a fragipan. Also included are areas of severely eroded soils and small areas of alluvium along drainageways. Included areas make up about 10 percent of the map unit.

Available water capacity is moderate in the Cincinnati soil, and permeability is slow. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer is strongly acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth.

Most areas are used for pasture or hay. Some are used as cropland or woodland.

This soil is suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Erosion, the equipment limitation, seedling mortality, windthrow, and plant competition are

the main management concerns. Logging roads and skid trails should be built on the contour. The trees should be logged only during dry periods or when the ground is frozen. Clear cutting should be avoided. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by cutting, spraying, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings. The slope can be modified to some extent by cutting and filling. The dwellings should be designed so that they conform to the natural slope of the land. The surface should be disturbed as little as possible, and vegetation should be established in the disturbed areas as soon as possible. The wetness is a moderate limitation on sites for dwellings with basements. It can be reduced, however, by properly sealing basement walls and by installing foundation drains.

Because of low strength, slope, and frost action, this soil is severely limited as a site for local roads and streets. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action. The roads and streets should be designed so that they conform to the natural slope of the land.

Because of the slow permeability and the slope, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IVe. The woodland ordination symbol is 2r.

Cm—Cobbsfork silt loam. This nearly level, deep, poorly drained soil is on wide ridgetops in the uplands. It is subject to ponding. Areas are irregularly shaped and range from 20 to more than 1,000 acres in size. The dominant size is about 200 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil extends to a depth of about 80 inches. It is light gray, mottled, friable and firm silt loam in the upper part; light gray and gray, mottled, firm silty clay loam in the next part; and dark yellowish brown and yellowish brown, mottled, very firm silt loam in the lower part.

Included with this soil in mapping are small areas of the somewhat poorly drained Avonburg and moderately well drained Rossmoyne soils. These soils are on the narrower ridgetops and in narrow areas adjacent to the steeper side slopes. They make up about 5 percent of the map unit.

Available water capacity is high in the Cobbsfork soil, and permeability is very slow. The organic matter content is moderate in the surface layer. Surface runoff is slow. Reaction in the surface layer varies widely because of local liming practices. It is very strongly acid or strongly acid in areas that have not been limed. The very firm, dense layer in the subsoil limits rooting depth. A seasonal high water table is near or above the surface in winter and early in spring.

Many areas have been drained and are used as cropland. Some are used for hay and pasture. Many undrained areas are used as woodland.

This soil is suited to cropland. Corn, soybeans, and winter wheat are the most common crops. The wetness is the major limitation. Surface drains remove excess water. Subsurface drains generally are not entirely satisfactory because of the very slow permeability in the subsoil. A bedding system has been used to reduce the wetness in some areas but with limited results. Obtaining outlets for drainage systems commonly is difficult. Cover crops and crop residue management help to maintain or improve tilth and increase the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is better suited to grasses than to deep-rooted legumes because of the wetness. Artificial drainage is needed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is suited to trees. The equipment limitation, seedling mortality, windthrow, and plant competition are the main management concerns. The trees should be harvested only during dry periods or when the ground is frozen. If seedlings are planted during periods when moisture conditions are favorable, extensive replanting is not needed. The species selected for planting should be those that can withstand the seasonal wetness. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Seedlings survive and grow if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the ponding, this soil is severely limited as a site for dwellings. A properly designed perimeter drainage system is needed to lower the water table. Adequate outlets commonly are not available. As a result, pumping is needed. The soil is severely limited as a site for local roads and streets because of ponding and frost action. These limitations can be overcome by establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel.

Because of the ponding and the very slow permeability, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IIIw. The woodland ordination symbol is 1w.

Dr—Dearborn fine sandy loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for very brief periods in winter and early in spring. Areas are long and narrow and are 10 to 40 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is brown fine sandy loam about 10 inches thick. The subsoil extends to a depth of about 31 inches. It is dark yellowish brown, friable loam in the upper part; dark yellowish brown, friable channery sandy loam in the next part; and yellowish brown, very friable channery loamy coarse sand in the lower part. The underlying material to a depth of 60 inches is light yellowish brown channery coarse sand. In some areas the surface layer is darker. In other areas it has limestone fragments. In places the soil has a lower content of coarse fragments throughout.

Included with this soil in mapping are small areas of the more acid Wirt soils. Also included are small areas of sandy overwash near stream channels. Included areas make up about 12 percent of the map unit.

Available water capacity is low in the Dearborn soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer is mildly alkaline or moderately alkaline.

Most areas are used for hay and pasture. Some are used as woodland or cropland.

This soil is suited to cropland. Corn and soybeans are the most common crops. The main limitation is droughtiness. Crops are subject to stress during extended periods of below average rainfall. The flooding is a hazard, but it usually does not occur during the cropping season. It limits the use of this soil for winter wheat. Applying measures that protect the cropland from floodwater generally is not economical. Cover crops and crop residue management improve tilth and increase the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition and the equipment limitation are the main management concerns. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by cutting, spraying, or girdling. In some areas the use of planting equipment is limited by rock fragments.

This soil generally is unsuitable as a site for dwellings and septic tank absorption fields because of the flooding.

The land capability classification is IIIs. The woodland ordination symbol is 2f.

EdE—Eden flaggy silty clay loam, 18 to 25 percent slopes. This moderately steep, moderately deep, well drained soil is on side slopes in the uplands. Areas are irregularly shaped and are 20 to 50 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is brown flaggy silty clay loam about 6 inches thick. The subsoil is dark yellowish brown and light olive brown, firm flaggy silty clay about 17 inches thick. Weathered shale and fractured limestone are at a depth of about 23 inches. In some areas the surface layer is not flaggy. In other areas it is dark. In places the slope is more than 25 or less than 18 percent.

Included with this soil in mapping are small areas of the deep Carmel soils on the upper side slopes. Also included are areas of severely eroded soils; areas of rock outcrops, escarpments, and sinkholes; and narrow alluvial areas along small drainageways. Included areas make up about 5 percent of the map unit.

Available water capacity is low in the Eden soil, and permeability is slow. The organic matter content is moderate in the surface layer. Surface runoff is very rapid. The surface layer is slightly acid or neutral.

Most of the acreage is pasture. Many areas are used as woodland.

This soil generally is unsuited to cropland, mainly because the hazard of erosion is severe. The moderately steep slope limits the use of equipment. The slope and the flaggy surface layer prevent the application of measures that help to control erosion on cropland.

This soil is suited to grasses and legumes for pasture. The moderately steep slope and the flaggy surface layer limit the use of equipment needed for harvesting hay. Special management is needed to establish and maintain stands of desirable grasses and legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is suited to trees. Erosion, the equipment limitation, seedling mortality, windthrow, and plant competition are the main management concerns. Logging roads and skid trails should be built on the contour. The trees should be logged only during dry periods. Planting is difficult because of the flaggy surface layer. Clear cutting should be avoided. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by cutting, spraying, or girdling.

Mainly because the slope is a severe limitation, this soil generally is unsuitable as a site for dwellings, septic tank absorption fields, and local roads and streets. The moderately steep slope limits the use of construction equipment. Special design, specific site information, and special construction practices are needed.

The land capability classification is VIe. The woodland ordination symbol is 3r.

EdF—Eden flaggy silty clay loam, 25 to 50 percent slopes. This steep and very steep, moderately deep, well drained soil is on side slopes in the uplands. Areas are irregularly shaped and are 20 to 200 acres in size. The dominant size is about 50 acres.

In a typical profile, the surface layer is very dark grayish brown flaggy silty clay loam about 3 inches thick. The subsoil extends to a depth of about 40 inches. It is yellowish brown and dark yellowish brown, firm flaggy silty clay in the upper part and olive yellow, mottled, firm flaggy silty clay loam in the lower part. Weathered shale and fractured limestone are at a depth of about 40 inches. In some areas the surface layer is not flaggy. In other areas the slope is more than 50 or less than 25 percent.

Included with this soil in mapping are small areas of the deep Carmel soils on the upper side slopes. Also included are areas of severely eroded soils; areas of rock outcrops, escarpments, and sinkholes; and narrow alluvial areas along small drainageways. Included areas make up about 5 percent of the map unit.

Available water capacity is low in the Eden soil, and permeability is slow. The organic matter content is moderate in the surface layer. Surface runoff is very rapid. The surface layer is slightly acid or neutral.

Most of the acreage is woodland. A few areas have been cleared and are used for pasture.

This soil generally is unsuited to cropland, mainly because the hazard of erosion is severe. The steep and very steep slope limits the use of farm equipment. The slope and the flaggy surface layer limit the application of measures that help to control erosion on cropland.

This soil generally is unsuited to grasses and legumes for pasture. The steep and very steep slope and the flaggy surface layer are limitations.

Many areas support native hardwoods. This soil is suited to trees. Erosion, the equipment limitation, seedling mortality, windthrow, and plant competition are the main management concerns. Logging roads and skid trails should be built on the contour. The trees should be logged only during dry periods. Planting is difficult because of the flaggy surface layer. Clear cutting should be avoided. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by cutting, spraying, or girdling.

Mainly because of the steep and very steep slope, this soil generally is unsuitable as a site for dwellings, septic tank absorption fields, and local roads and streets.

The land capability classification is VIIe. The woodland ordination symbol is 3r.

EkB—Elkinsville silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on stream terraces. Areas are irregular in shape and are 3 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 58 inches. It is yellowish brown, firm silt loam in the upper part; strong brown, firm clay loam in the next part; and strong brown, mottled, friable sandy clay loam in the lower part. The underlying material to a depth of about 70 inches is yellowish brown, mottled, friable stratified loam and clay loam. In some places the soil is deeper to the underlying material. In other places the surface layer is darker. In some areas the content of gravel in the underlying material is 10 to 30 percent. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil are some small areas of the somewhat poorly drained Bartle and moderately well drained Pekin soils. These soils are in positions on the landscape similar to those of the Elkinsville soil. Also included are small areas of eroded and severely eroded soils and small areas of nearly level soils that have low chroma mottles in the upper part of the subsoil. Included soils make up about 10 percent of the map unit.

Available water capacity is high in the Elkinsville soil, and permeability is moderate. The organic matter content is moderately low in the surface layer. Surface runoff is medium. The surface layer is medium acid or strongly acid unless limed.

Most of the acreage is cropland. A few areas are used for hay and pasture or for woodland.

This soil is well suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. Crop residue management and cover crops help to control erosion and maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings will survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Installing footing tile below the frost line and backfilling with

coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of frost action and low strength. These limitations can be overcome by providing a more stable base material, such as sand or gravel, by establishing adequate road ditches, and by installing culverts. The soil is suitable as a septic tank absorption field.

The land capability classification is IIe. The woodland ordination symbol is 1a.

EkC2—Elkinsville silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on side slopes on stream terraces. Areas generally are long and narrow and are 5 to 15 acres in size. The dominant size is about 8 acres.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of about 55 inches. It is yellowish brown, firm and friable silty clay loam in the upper part and yellowish brown, mottled, firm silty clay loam in the lower part. The underlying material to a depth of 80 inches is yellowish brown, mottled silty clay loam. In places the slope is less than 6 or more than 12 percent. In some areas the underlying material is coarser textured.

Included with this soil in mapping are areas of soils in which the content of sand is more than 15 percent in the control section. These soils are in positions on the landscape similar to those of the Elkinsville soil. Also included are small areas of severely eroded soils and, on toe slopes, areas of soils that have a fine textured subsoil containing limestone cobbles and flagstones. Included soils make up about 15 percent of the map unit.

Available water capacity is high in the Elkinsville soil, and permeability is moderate. The organic matter content is moderately low in the surface layer. Surface runoff is rapid. The surface layer is medium acid or strongly acid unless limed.

Most areas are used as cropland. Many are used for hay and pasture. A few are used as woodland.

This soil is suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures may be needed. Crop residue management and cover crops help to control erosion and maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slopes, this soil is moderately limited as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Adequately reinforcing foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and frost action. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the slope, this soil is moderately limited as a septic tank absorption field. The absorption field should be installed on the contour.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

ErF—Eden-Rock outcrop complex, 25 to 50 percent slopes. This map unit occurs as areas of a steep and very steep, moderately deep, well drained Eden soil closely intermingled with areas of Rock outcrop. It is on upland side slopes. Areas generally are long and narrow and are 10 to 50 acres in size, dominantly about 30 acres. They are 40 to 60 percent Eden soil and 25 to 35 percent Rock outcrop. The Eden soil and Rock outcrop occur as areas so intricately intermingled that mapping them separately is not practical.

Typically, the Eden soil has a surface layer of very dark grayish brown silty clay loam about 6 inches thick. The subsoil extends to a depth of about 34 inches. It is dark yellowish brown, firm silty clay loam and silty clay in the upper part and yellowish brown, firm flaggy silty clay in the lower part. Soft shale and limestone are at a depth of about 34 inches.

Typically, the Rock outcrop consists of large limestone ledges. Boulders and fragments of shale and chert are common.

Included with the Eden soil and Rock outcrop in mapping are small areas of the deep Grayford soils near the head of drainageways and areas of deep soils that have a subsoil of red clay and are on the upper side slopes. Also included are areas of shallow soils that have a dark or moderately dark surface layer; deep soils that are silt loam throughout and that have common to many gravel-sized chert fragments; and small areas of alluvial soils along narrow drainageways. Included soils make up 0 to 25 percent of the mapped areas. No one

inclusion makes up more than 15 percent of any one mapped area.

Available water capacity is low in the Eden soil, and permeability is slow. The organic matter content is high in the surface layer. Surface runoff is very rapid.

Most areas are used as woodland. A few have been cleared and are used for pasture.

This map unit generally is unsuited to cropland, mainly because the hazard of erosion is severe. The steep and very steep slope and the Rock outcrop limit the use of farm machinery.

This map unit is suited to grasses and legumes for pasture. The steep and very steep slope and the Rock outcrop limit the use of equipment needed for harvesting hay. Special management is needed to establish and maintain stands of desirable grasses and legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. The Eden soil is suited to trees. Erosion, the equipment limitation, seedling mortality, windthrow, and plant competition are the main management concerns. Logging roads and skid trails should be built on the contour. The trees should be logged only during dry periods. Planting is difficult because of the Rock outcrop and the depth to the flaggy part of the subsoil. Clear cutting should be avoided. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by cutting, spraying, or girdling.

Because of the exposed rock and the slope, this map unit generally is unsuited to dwellings, septic tank absorption fields, and local roads and streets.

The land capability classification is VIIe. The Eden soil is assigned to woodland ordination symbol 3r.

GrD2—Grayford silty clay loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and are 10 to 20 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil extends to a depth of about 80 inches. It is yellowish brown, friable silt loam and clay loam in the upper part; strong brown, firm clay loam and brownish yellow, firm clay in the next part; and red, firm clay in the lower part. In areas the upper part of the subsoil is thinner. In several places the lower part of the subsoil formed in glacial till and contains less clay. In some small areas the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of Ryker soils in the higher landscape positions. These soils contain more silt and less sand in the upper part of the subsoil than the Grayford soil. Also included are small areas where the surface layer is gravelly or cherty, areas of severely eroded soils, and areas of alluvial soils in narrow drainageways. Included areas make up about 15 percent of the map unit.

Available water capacity is high in the Grayford soil, and permeability is moderate. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer is strongly acid unless limed. It tends to be sticky and cloddy unless it is tilled within a fairly narrow range in moisture content.

Most areas are used for hay and pasture. Many are used as cropland or woodland.

This soil is poorly suited to cropland. The most common crops are corn, soybeans, and winter wheat. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings and septic tank absorption fields. The dwellings should be designed so that they conform to the natural slope of the land. Measures that help to control erosion in disturbed areas are needed. Septic tank absorption fields should be specially designed so that the effects of slope are overcome. Alternative methods of sewage disposal should be considered. The soil is severely limited as a site for local roads and streets because of slope and frost action. The roads and streets should be built on the contour as much as possible. Providing a more stable base material, such as sand or gravel, establishing adequate road ditches, and installing culverts help to prevent the damage caused by frost action.

The land capability classification is IVe. The woodland ordination symbol is 1a.

GrE—Grayford silt loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil

is on side slopes in the uplands. Areas are irregular in shape and are 10 to 50 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 80 inches. It is yellowish brown, friable loam in the upper part; strong brown, firm clay loam in the next part; and red and reddish brown, firm clay in the lower part. In places the depth to clay residuum is more than 50 inches. In some areas the slope is less than 18 percent. In other areas bedrock is within a depth of 60 inches.

Included with this soil in mapping are small areas of rock outcrops near toe slopes, small areas of alluvial soils along narrow drainageways, and small areas of severely eroded soils. Included areas make up about 15 percent of the map unit.

Available water capacity is high in the Grayford soil, and permeability is moderate. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer is very strongly acid or strongly acid unless limed.

Most areas are used as woodland or pasture. This soil generally is unsuited to cropland because of a severe hazard of erosion. Small grain is occasionally grown to help establish stands of grasses and legumes in the less sloping areas. The slope limits the use of farm equipment.

This soil is suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. The slope limits the use of farm equipment. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Erosion, the equipment limitation, and plant competition are the main management concerns. Special machinery may be needed to improve the efficiency of harvesting. Logging roads should be built on the contour as much as possible. Clear cutting should be avoided. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil generally is unsuitable as a site for dwellings, septic tank absorption fields, and local roads and streets.

The land capability classification is VIe. The woodland ordination symbol is 1r.

Hd—Haymond silt loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for brief periods in winter and early in spring. Areas generally are long and narrow and are 3 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 55 inches. The upper part is brown, friable silt loam, and the lower part is dark brown, friable loam. The underlying material to a depth of about 60 inches is dark yellowish brown stratified loam, sandy loam, and sand. In some areas the surface layer is darker. In other areas the coarser textured layers are closer to the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Holton and Wakeland and moderately well drained Lobdell soils in the lower lying depressions. Included soils make up about 15 percent of the map unit.

Available water capacity is high in the Haymond soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer is slightly acid or neutral.

Most areas are used as pasture or hayland. Many are used as woodland or cropland.

This soil generally is well suited to cropland. It is not well suited to winter wheat, however, because of the flooding in winter and early in spring. Corn and soybeans are the most common crops. The flooding occasionally causes some crop loss. Applying measures that totally protect the cropland from floodwater generally is not economical. A conservation tillage system that leaves all or part of the crop residue on the surface and cover crops help to maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings will survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding and frost action. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by floodwater. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 1a.

HkD2—Hickory silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and are 10 to 30 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of about 47 inches. It is yellowish brown, friable silt loam in the upper part and yellowish brown, mottled, firm clay loam in the lower part. The underlying material to a depth of about 60 inches is yellowish brown, mottled clay loam. In some areas the subsoil contains more clay. In a few areas gray mottles are as shallow as 30 inches. In places the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of Cincinnati soils, which have a fragipan. These soils are in positions on the landscape similar to those of the Hickory soil. Also included are small areas of alluvium along narrow drainageways and small areas of uneroded or severely eroded soils. Included areas make up about 10 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer is medium acid unless limed.

Most areas are used for hay and pasture. Some are used as woodland. A few are used as cropland.

This soil is poorly suited to cropland. The most common crops are corn, soybeans, and winter wheat. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Adequately reinforcing footings and concrete structures, backfilling with a more stable base material, such as sand or gravel, and installing foundation drains help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The surface should be disturbed as little as possible, and vegetation should be reestablished in the disturbed areas as soon as possible. Because of low strength, the soil is severely limited as a site for local roads and streets. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength.

Because of the moderate permeability and the slope, this soil is moderately limited as a septic tank absorption field. The absorption field should be installed on the contour. Enlarging the field helps to overcome the restricted permeability.

The land capability classification is IVe. The woodland ordination symbol is 1a.

HkD3—Hickory silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and are 10 to 30 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown and yellowish brown silt loam about 6 inches thick. The subsoil is yellowish brown, firm and very firm clay loam about 64 inches thick. The underlying material to a depth of about 80 inches is yellowish brown loamy sand. In some places the subsoil is clay. In other places the surface layer is loam or clay loam. In some areas free carbonates are within a depth of 40 inches. In other areas the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of Cincinnati soils, which have a fragipan. These soils are in positions on the landscape similar to those of the Hickory soil. Also included are small areas of uneroded or moderately eroded soils and small areas of alluvial soils along narrow drainageways. Included soils make up about 12 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. The organic matter content is low in the surface layer. Surface runoff is very rapid. The surface layer is strongly acid unless limed. It tends to be sticky or cloddy unless tilled within a fairly narrow range in moisture content.

Most areas are used for hay and pasture. Some are used as cropland. A few are used as woodland.

This soil generally is unsuited to cropland, mainly because erosion is a hazard. Small grain may be occasionally grown to reestablish stands of grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Adequately reinforcing footings and concrete structures, backfilling with a more stable base material, such as sand or gravel, and installing foundation drains help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The surface should be disturbed as little as possible, and vegetation should be reestablished in the disturbed areas as soon as possible. Because of low strength, the soil is severely limited as a site for local roads and streets. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength.

Because of the moderate permeability and the slope, this soil is moderately limited as a septic tank absorption field. The absorption field should be installed on the contour. Enlarging the field helps to overcome the restricted permeability.

The land capability classification is VIe. The woodland ordination symbol is 1a.

HkE—Hickory loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil is on side slopes in the uplands. Areas are irregular in shape and are 10 to 100 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is light yellowish brown loam about 4 inches thick. The subsoil extends to a depth of about 43 inches. It is yellowish brown, friable loam in the upper part; yellowish brown, firm clay loam in the next part; and strong brown and brown, firm clay loam in the lower part. The underlying material to a depth of about 70 inches is brown, mottled clay loam. In some small areas the subsoil is coarser textured. In other small areas a buried subsoil is below a depth of 40 inches. In some places the slope is less than 18 or more than 35 percent. In places the subsoil is finer textured.

Included with this soil in mapping are small areas of Cincinnati soils on the upper side slopes, small areas of rock outcrops and escarpments, and areas where the surface layer is flaggy. Cincinnati soils have a fragipan. Also included are small areas of severely eroded soils; small areas of alluvial soils along narrow drainageways; and, on toe slopes, small areas where clay residuum is below a depth of 40 inches. Included areas make up about 5 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer is medium acid or slightly acid.

Most areas are used as woodland or pasture (fig. 4). Some of the less sloping areas are used for hay. A few areas are used as cropland.

This soil generally is unsuited to cropland because of a severe hazard of erosion. Small grain may be grown occasionally so that stands of grasses and legumes can be reestablished. The slope limits the use of farm equipment.

This soil is suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. The slope limits the use of farm equipment. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Erosion, the equipment limitation, and plant competition are the main management concerns. The slope limits the use of conventional logging equipment. Logging roads should be built on the contour as much as possible. Clear cutting should be avoided. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Mainly because the slope is a severe limitation, this soil generally is unsuitable as a site for dwellings, septic tank absorption fields, and local roads and streets. The slope limits the use of construction equipment.

The land capability classification is VIe. The woodland ordination symbol is 1r.

Hn—Holton silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land. It is frequently flooded for brief periods in winter and early in spring. Areas are long and narrow and are 10 to 40 inches in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsurface layer is brown loam about 7 inches thick. The subsoil is grayish brown, mottled, friable fine sandy loam about 27 inches thick. The underlying material to a depth of about 60 inches is grayish brown, mottled fine sandy loam. In some places thin strata of silt loam are in the subsoil. In other places the surface layer is loam. In some areas the subsoil is more weakly expressed. In other areas the content of coarse fragments is as much as 30 percent below a depth of 30 inches. In places the subsoil contains more clay or more silt.

Included with this soil in mapping are small areas of the well drained Haymond and Wirt and moderately well drained Lobdell soils on the slightly higher parts of the landscape. Also included are small areas of sand near stream channels. Included areas make up about 15 percent of the map unit.

Available water capacity is high in the Holton soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer generally is

Figure 4.—Fescue pasture on Hickory loam, 18 to 35 percent slopes.

medium acid or slightly acid. A seasonal high water table is at a depth of 1 to 3 feet in winter and early in spring.

Most areas are used for hay and pasture. Many are used as cropland. Some are used as woodland.

This soil is suited to cropland. Corn and soybeans are the most common crops. The main limitation is the wetness. Subsurface drains and open ditches help to lower the water table. Surface drains help to remove excess water. The flooding is a hazard, but it does not usually occur during the cropping season. It limits the use of this soil for winter wheat. Applying measures that prevent flooding generally is not economical. Cover crops and crop residue management improve tilth and increase the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is better suited to grasses than to deep-rooted legumes because of the seasonal high water table. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings will survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding and the wetness are severe limitations, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding and frost action. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by floodwater. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2a.

Lb—Lobdell silt loam, frequently flooded. This nearly level, deep, moderately well drained soil is on bottom land. It is frequently flooded for brief periods in winter and early in spring. Areas generally are long and narrow and are 5 to 30 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is brown, mottled, friable silt loam about 19 inches thick. The upper part of the underlying material is pale brown, mottled, friable loam. The lower part to a depth of about

60 inches is grayish brown, mottled gravelly sandy clay loam. In places the soil is silt loam to a depth of 40 inches. In some areas it has received loamy overwash. In other areas it has thin strata of sand within a depth of 40 inches.

Included with this soil in mapping are some small areas of the somewhat poorly drained Algiers, Holton, and Wakeland soils on the slightly lower parts of the landscape. Also included are the well drained Haymond and Wirt soils on the slightly higher parts. Included soils make up about 15 percent of the map unit.

Available water capacity is high in the Lobdell soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer is neutral. A seasonal high water table is at a depth of 2.0 to 3.5 feet during winter and spring.

Most areas are used for hay and pasture. Many are used as cropland. Some are used as woodland.

This soil is well suited to cropland. Corn and soybeans are the most common crops. The flooding is the main hazard. It occasionally causes some crop damage. Applying measures that totally protect the cropland from floodwater generally is not economical. Cover crops and a conservation tillage system that leaves all or part of the crop residue on the surface improve tilth and increase the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding and the wetness are severe limitations, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding and frost action. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by floodwater. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 1a.

No—Nolin silt loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for brief periods in winter and early in spring. Areas are irregular in shape and are 10 to 40 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of about 80 inches. It is dark yellowish brown, friable or firm silt loam, clay loam, and loam. In some places the soil has received 6 to 12 inches of recent overwash. In other places it has a dark surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Wakeland soils in depressions and small areas of Wirt soils. Wirt soils contain more sand than the Nolin soil. Also included are small areas of poorly drained soils in old stream channels. Included soils make up about 15 percent of the map unit.

Available water capacity is high in the Nolin soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer is neutral. A seasonal high water table is at a depth of 3 to 6 feet during winter and spring.

Most areas are used as cropland. Some are used as woodland. A few are used as pasture.

This soil generally is well suited to cropland. It is not well suited to winter wheat, however, because of the flooding in winter and early in spring. Corn and soybeans are the most common crops. The flooding occasionally causes some crop loss. Applying measures that totally protect the cropland from floodwater generally is not economical. Cover crops and crop residue management help to maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition and the equipment limitation are the main management concerns. The trees should be harvested only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding and low strength. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by floodwater. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength.

The land capability classification is IIw. The woodland ordination symbol is 1w.

PeB2—Pekin silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on terraces. Areas are irregular in shape and are 3 to 15 acres in size. The dominant size is about 8 acres.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The part of the subsoil above a fragipan extends to a depth of about 23 inches. The upper part is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, firm silty clay loam. Below this to a depth of about 68 inches is the fragipan. It is light brownish gray, mottled, very firm silty clay loam in the upper part and strong brown, mottled, firm clay in the lower part. The underlying material to a depth of about 80 inches is light brownish gray, mottled, firm clay. In some places it is stratified with textures ranging from sandy loam to silty clay loam. In other places the fragipan is thinner. In some areas the slope is less than 2 percent. In other areas the depth to mottles is greater.

Included with this soil are some small areas of the somewhat poorly drained Bartle soils in depressions and the well drained Elkinsville soils on the low parts of the terraces. Also included are small areas of severely eroded soils. Included soils make up about 10 percent of the map unit.

Available water capacity is moderate in the Pekin soil, and permeability is very slow. The organic matter content is moderate in the surface layer. Surface runoff is rapid. The surface layer is strongly acid or medium acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth. A seasonal high water table is at a depth of 2 to 6 feet in winter and early in spring.

Most of the acreage is cropland. A few areas are used for hay and pasture or for woodland.

This soil is well suited to cropland. The main crops are corn, soybeans, and small grain. Erosion is the main hazard. Measures that help to control erosion and surface runoff are the main management needs. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures may be needed. During extremely dry years, crops may be adversely affected by a lack of available water because the fragipan limits the depth of root penetration. Crop residue management and cover crops help to control erosion and maintain or improve tilth, the organic matter content, and the available water capacity.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and severely limited as a site for dwellings with basements. A properly designed perimeter drainage system is needed to remove excess water. Foundation drains should be installed, and basement walls should be properly sealed. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the very slow permeability and the wetness, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IIe. The woodland ordination symbol is 3a.

Pt—Pits, Quarry. This map unit consists of open excavations from which soil and the underlying limestone have been removed. The sides of the excavations are nearly vertical, and the bottom is nearly level. The excavations are 40 to 60 feet deep. The depth of the soil material over bedrock was 10 to 20 feet. Areas are 3 to 50 acres in size. The dominant size is about 30 acres. These areas support few or no plants. Included in mapping are large piles of soil overburden and stockpiled limestone gravel. The overburden supports native grasses and forbs, such as broom sedge and ragweed, in some areas. Some areas have been seeded to fescue.

The crushed limestone from these quarries is used mainly for resurfacing local roads or for agricultural lime. When left idle, the excavated areas fill with water.

This map unit is not assigned to a land capability classification or a woodland ordination symbol.

RoA—Rossmoyne silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on ridgetops in the uplands. Areas generally are circular or elongated and are 5 to 30 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is light yellowish brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown, mottled, friable silt loam about 16 inches thick. The lower part to a depth of about 80 inches is a fragipan of yellowish brown, mottled, very firm silty clay loam and silt loam. In places the soil does not have a subsurface layer. In some areas the depth to the fragipan is more than 30 inches. In other areas the soil does not have grayish mottles above the fragipan.

Included with this soil in mapping are small areas of the somewhat poorly drained Avonburg soils. These soils are in positions on the landscape similar to those of the

Rossmoyne soil. They make up about 5 percent of the map unit.

Available water capacity is moderate in the Rossmoyne soil, and permeability is slow. The organic matter content is moderate in the surface layer. Surface runoff is slow. The surface layer is medium acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter and early in spring.

Most areas are used as cropland. Some are used for hay and pasture. A few are used as woodland.

This soil is well suited to cropland. Corn, soybeans, and small grain are the main crops. The wetness is the main limitation. Surface drains help to remove excess water. During extremely dry periods, crops may be adversely affected by a lack of moisture because the fragipan limits the depth of root penetration. A conservation tillage system that leaves all or part of the crop residue on the surface and cover crops help to maintain or improve tilth, the available water capacity, and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings with basements. It is moderately limited as a site for dwellings without basements because of the wetness and the shrink-swell potential. A properly designed perimeter drainage system is needed to remove the water perched on the fragipan. Foundation drains may be needed, and basement walls should be properly sealed. Installing footing tile below the frost line and adequately reinforcing foundations and concrete structures help to prevent the structural damage caused by shrinking and swelling.

Because of low strength and frost action, this soil is severely limited as a site for local roads and streets. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the slow permeability and the wetness, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IIw. The woodland ordination symbol is 2d.

RoB2—Rossmoyne silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on uplands. Areas generally are long and narrow and are 3 to 100 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The part of the subsoil above a fragipan extends to a depth of about 28 inches. It is light brownish yellow, friable silt loam in the upper part and yellowish brown, friable, mottled silt loam in the lower part. The fragipan to a depth of about 80 inches is light gray, mottled, very firm silt loam and silty clay loam. In some small areas the slope is more than 6 or less than 2 percent. In some places mottles are throughout the subsoil. In other places the soil does not have grayish mottles above the fragipan.

Included with this soil in mapping are small areas of the somewhat poorly drained Avonburg soils. These soils are in positions on the landscape similar to those of the Rossmoyne soil. Also included are small areas of uneroded or severely eroded soils. Included soils make up about 5 percent of the map unit.

Available water capacity is moderate in the Rossmoyne soil, and permeability is slow. The organic matter content is moderate in the surface layer. Surface runoff is rapid. The surface layer generally is medium acid unless limed. The very firm, dense fragipan in the subsoil limits rooting depth. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter and early in spring.

Most areas are used as cropland. Some are used for hay and pasture or for woodland.

This soil is well suited to cropland. Corn, soybeans, and small grain are the main crops. Erosion is the main hazard (fig. 5). Measures that help to control erosion and surface runoff are the main management needs. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures may be needed. During extremely dry periods, crops may be adversely affected by a lack of available water because the fragipan limits the depth of root penetration. Cover crops and crop residue management help to control erosion and maintain or improve tilth, the organic matter content, and the available water capacity.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Figure 5.—Soybean seedlings damaged by erosion on Rossmoyne silt loam, 2 to 6 percent slopes, eroded.

Some areas support native hardwoods. This soil is well suited to trees. Windthrow, seedling mortality, and plant competition are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Some replanting may be needed. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings with basements. It is moderately limited as a site for dwellings without basements because of the wetness and the shrink-swell potential. A properly designed perimeter drainage system is needed to remove the water perched on the fragipan. Foundation drains may be needed, and basement walls should be properly sealed. Installing footing tile below the frost line and adequately reinforcing foundations and concrete structures help to prevent the structural damage caused by shrinking and swelling.

Because of low strength and frost action, this soil is severely limited as a site for local roads and streets. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the slow permeability and the wetness, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IIe. The woodland ordination symbol is 2d.

RyC2—Ryker silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil

is on side slopes and ridgetops in the uplands. Areas are irregular in shape and are 3 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 80 inches. The upper part is yellowish brown, friable or firm silt loam or silty clay loam; the next part is strong brown, firm loam; and the lower part is red, mottled, firm clay. In places the upper part of the subsoil is thinner. In some areas the slope is less than 6 percent. In other areas the depth to clay residuum is more than 80 inches.

Included with this soil in mapping are small areas of Cincinnati soils on the higher parts of the landscape. These soils have a fragipan. Also included are small areas of severely eroded soils and small areas of gravel and cobble-sized chert. Included areas make up about 10 percent of the map unit.

Available water capacity is high in the Ryker soil, and permeability is moderate. The organic matter content is moderate in the surface layer. Surface runoff is rapid. The surface layer is strongly acid unless limed.

Most areas are used as woodland. Many are used as pasture and hayland. Some are used as cropland.

This soil is suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Adequately reinforcing foundations and concrete structures, backfilling with a more stable base material, such as sand or gravel, and installing foundation drains and expansion joints help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. Cutting and filling may be needed to modify the slope. Measures that help to control erosion in disturbed areas are needed.

Because of low strength and frost action, this soil is severely limited as a site for local roads and streets. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by low strength and frost action.

Because of the moderate permeability and the slope, this soil is moderately limited as a septic tank absorption field. Increasing the length of the laterals helps to overcome the restricted permeability. The absorption field should be designed so that it conforms to the natural slope of the land. A public or commercial sewer system may be needed.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

St—Stonelick loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for very brief periods in winter and early in spring. Areas generally are long and narrow and are 5 to 30 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is brown loam about 9 inches thick. The upper part of the underlying material is dark yellowish brown, friable fine sandy loam. The lower part to a depth of about 60 inches is yellowish brown, very friable fine sandy loam that has strata of loamy fine sand and fine sand. In some places the coarser textures are closer to the surface. In other places the soil contains more silt and less sand throughout. In some areas strata of gravel are below a depth of 40 inches.

Included with this soil in mapping are small areas of the more channery Dearborn and more acid Wirt soils. These soils are in positions on the landscape similar to those of the Stonelick soil. Also included, near stream channels, are small areas where coarse fragments are on the surface. Included areas make up about 12 percent of the map unit.

Available water capacity is moderate in the Stonelick soil, and permeability is moderately rapid. The organic matter content is moderate in the surface layer. This layer is moderately alkaline.

Most areas are used as cropland. Some are used as woodland. A few are used as pasture.

This soil generally is well suited to cropland. It is not well suited to winter wheat, however, because of the flooding in winter and early in spring. Corn and soybeans are the most common crops. The flooding occasionally causes some crop loss. Applying measures that totally protect the cropland from floodwater generally is not economical. A conservation tillage system that leaves all or part of the crop residue on the surface and cover crops help to maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet,

however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding. Building the roads and streets on raised, well compacted fill material, establishing adequate road ditches, and installing culverts help to prevent the damage caused by floodwater.

The land capability classification is IIw. The woodland ordination symbol is 2a.

SwC2—Switzerland silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on side slopes and ridgetops in the uplands. Areas generally are oblong and are 5 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of about 64 inches. It is yellowish brown and firm. The upper part is silt loam and silty clay loam, and the lower part is silty clay. Soft, weathered shale and thin strata of interbedded limestone are at a depth of about 64 inches. More than 40 inches of loess covers some areas. In other areas limestone flagstones are within a depth of 40 inches. In places reddish mottles are in the lower part of the subsoil. In some small areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are a few small areas of the more clayey Carmel soils and, on the higher parts of the landscape, areas of Cincinnati soils, which have a fragipan. Also included are small areas of soils that have thin layers of firm, dense material and are on ridgetops, areas of uneroded and severely eroded soils, and small areas where sinkholes and rock outcrops are common. Included areas make up about 12 percent of the map unit.

Available water capacity is high in the Switzerland soil. Permeability is moderate in the upper part of the soil and very slow in the lower part. The organic matter content is moderately low in the surface layer. Surface runoff is rapid. The surface layer is strongly acid or medium acid unless limed.

Most areas are used as woodland. Many are used as pasture and hayland. Some are used as cropland.

This soil is suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture (fig. 6). Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings with basements. It is moderately limited as a site for dwellings without basements because of the slope and the shrink-swell potential. Adequately reinforcing concrete foundations and structures, backfilling with sand or gravel, and installing foundation drains and expansion joints help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. Cutting and filling may be needed to modify the slope. The soil is severely limited as a site for local roads and streets because of low strength and frost action. These limitations can be overcome by establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel.

Because of the very slow permeability, this soil is severely limited as a septic tank absorption field. A public or commercial sewer system or an alternative method of waste disposal is needed.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

SwD2—Switzerland silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on side slopes in the uplands. Areas generally are oblong and are 3 to 30 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of about 65 inches. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish brown and strong brown, mottled, firm silty clay. Weathered shale and limestone are at a depth of about 65 inches. In places limestone flagstones are closer to the surface. More than 40 inches of loess covers some small areas. In other small areas the slope is less than 12 percent.

Figure 6.—Beef cattle on a fescue pasture in an area of Switzerland silt loam, 6 to 12 percent slopes, eroded.

Included with this soil in mapping are a few small areas of Carmel soils and, on the higher parts of the landscape, areas of Cincinnati soils, which have a fragipan. Carmel soils contain more clay throughout the subsoil than the Switzerland soil. Also included are small areas where sinkholes and rock outcrops are common, small areas of severely eroded soils, small areas of alluvial soils along narrow drainageways, and small areas of soils that have thin layers of firm, dense material. Included soils make up about 15 percent of the map unit.

Available water capacity is high in the Switzerland soil. Permeability is moderate in the upper part of the soil and very slow in the lower part. The organic matter content is moderately low in the surface layer. Surface runoff is very rapid. The surface layer is strongly acid or medium acid unless limed.

Most areas are used as woodland. Many are used as pasture and hayland. Some are used as cropland.

This soil is suited to cropland. The most common crops are corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled, however, by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally is needed. Crop residue management and cover crops help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because of the slope and the shrink-swell potential, this soil is severely limited as a site for dwellings with basements. It is severely limited as a site for dwellings without basements because of the slope. Adequately reinforcing concrete foundations and structures, backfilling with sand or gravel, and installing foundation drains and expansion joints help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. Cutting and filling may be needed to modify the slope. The soil is severely limited as a site for local roads and streets because of low strength, frost

action, and slope. Low strength and frost action can be overcome by establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel. The roads and streets should be built on the contour as much as possible.

Because of the very slow permeability and the slope, this soil is severely limited as a septic tank absorption field. An alternative method of waste disposal or a public or commercial sewer system is needed.

The land capability classification is IVe. The woodland ordination symbol is 1a.

Wa—Wakeland silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land. It is frequently flooded for brief periods in winter and early in spring. Areas generally are long and narrow and are 5 to 30 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 6 inches thick. The upper part of the underlying material is pale brown, mottled, friable silt loam. The next part is light brownish gray, mottled, friable silt loam. The lower part to a depth of about 60 inches is yellowish brown, mottled stratified loam, sandy loam, and clay loam. In some places the soil is silt loam throughout. In other places it has thin strata of sand within a depth of 40 inches.

Included with this soil in mapping are small areas of the well drained Haymond and moderately well drained Lobdell soils. These soils are closer to the stream channels than the Wakeland soil. Also included are small areas of poorly drained soils in depressions. Included soils make up about l5 percent of the map unit.

Available water capacity is high in the Wakeland soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer is neutral or slightly acid. A seasonal high water table is at a depth of 1 to 3 feet in winter and spring.

Most areas are used for hay and pasture. Many are used as cropland. Some are used as woodland.

This soil is well suited to cropland. Corn and soybeans are the most common crops. The main limitation is the wetness. Also, the flooding limits the use of this soil for winter wheat. A drainage system is needed to lower the water table. Subsurface drains, surface drains, or open ditches help to remove excess water. Crop residue management and cover crops improve tilth and increase the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is better suited to grasses than to deep-rooted legumes because of the seasonal high water table. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding and the wetness are severe limitations, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding and frost action. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by floodwater. Establishing adequate road ditches, installing culverts, and providing a more stable base material, such as sand or gravel, help to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 2a.

Wr—Wirt loam, flaggy clay substratum, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for very brief periods in winter and early in spring. Areas generally are long and narrow and are 5 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown loam about 9 inches thick. The subsoil extends to a depth of about 40 inches. The upper part is dark yellowish brown and yellowish brown, friable loam, and the lower part is yellowish brown, very friable fine sandy loam and sandy loam. The upper part of the underlying material is dark yellowish brown loamy sand. The lower part to a depth of about 60 inches is flaggy clay. In some places limestone bedrock is within a depth of 60 inches. In other places the coarser textures are closer to the surface. In some areas the soil is silt loam throughout. In other areas mottles are below a depth of 20 inches.

Included with this soil in mapping are small areas of the less acid Dearborn soils. Also included are areas of the moderately well drained Lobdell and somewhat poorly drained Wakeland and Holton soils on the slightly lower parts of the landscape. Included soils make up about 15 percent of the map unit.

Available water capacity is high in the Wirt soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer is neutral.

Most areas are used as pasture or hayland. Some are used as woodland or cropland.

This soil generally is well suited to cropland. It is poorly suited to winter wheat, however, because of the flooding in winter and early in spring. Corn and soybeans are the most common crops. The flooding occasionally causes some crop loss. Applying measures that totally protect the cropland from floodwater generally is not economical. A conservation tillage system that leaves all or part of the crop residue on the surface and cover crops help to maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by floodwater.

The land capability classification is IIw. The woodland ordination symbol is 2a.

Wt—Wirt silt loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for brief periods in winter and early in spring. Areas generally are long and narrow and are 5 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 40 inches of dark yellowish brown, friable loam and sandy loam. The underlying material to a depth of about 80 inches is yellowish brown, loose sand. In some areas the coarser textures are closer to the surface. In other areas mottles are below a depth of 20 inches.

Included with this soil in mapping are small areas of the less acid Dearborn soils and small areas of the somewhat poorly drained Holton soils. These soils are in positions on the landscape similar to those of the Wirt soil. They make up about 15 percent of the map unit.

Available water capacity is high in the Wirt soil, and permeability is moderate. The organic matter content is moderate in the surface layer. This layer is mildly alkaline.

Most areas are used as pasture or hayland. Some are used as woodland or cropland.

This soil generally is well suited to cropland. It is poorly suited to winter wheat, however, because of the flooding in winter and early in spring. Corn and soybeans are the most common crops. The flooding occasionally causes some crop loss. Applying measures that totally protect the cropland from floodwater generally is not economical. A conservation tillage system that leaves all or part of the crop residue on the surface and cover crops help to maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling.

Because the flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding. Building the roads and streets on raised, well compacted fill material helps to prevent the damage caused by floodwater.

The land capability classification is IIw. The woodland ordination symbol is 1a.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber and oilseed crops. It may be cropland, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber or is available for these uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to economically produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at local offices of the Soil Conservation Service.

About 193,986 acres throughout the survey area, or nearly 66 percent of the total acreage, meets the soil requirements for prime farmland. Most of the prime farmland is used for crops, mainly corn and soybeans.

Figure 7.—Urban development on Cobbsfork and Avonburg soils. The conversion of prime farmland to nonagricultural uses is a concern in the survey area.

The crops grown on this land account for most of the total agricultural income in the survey area.

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses (fig. 7). The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, are droughty, cannot be easily cultivated, and generally are less productive.

The map units that are considered prime farmland in the survey area are listed in this section. The list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Some of the map units meet the requirements for prime farmland only in areas where the soil is drained or protected from flooding, or both. The need for measures that overcome these limitations is shown in parentheses after the map unit name. Onsite evaluation is needed to determine whether or not the limitations have been overcome by corrective measures.

The map units that meet the soil requirements for prime farmland are:

Ag Algiers silt loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)

AvA Avonburg silt loam, 0 to 2 percent slopes (where drained)

AvB2 Avonburg silt loam, 2 to 6 percent slopes, eroded (where drained)

BaA Bartle silt loam, 0 to 2 percent slopes (where drained)

CcB2 Cincinnati silt loam, 2 to 6 percent slopes, eroded

Cm Cobbsfork silt loam (where drained)

EkB Elkinsville silt loam, 2 to 6 percent slopes, eroded

Hd Haymond silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)

Hn Holton silt loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)

Lb Lobdell silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)

No Nolin silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
PeB2 Pekin silt loam, 2 to 6 percent slopes
RoA Rossmoyne silt loam, 0 to 2 percent slopes
RoB2 Rossmoyne silt loam, 2 to 6 percent slopes, eroded
St Stonelick loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
Wa Wakeland silt loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)
Wr Wirt loam, flaggy clay substratum, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
Wt Wirt silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 182,685 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory. Of this total, about 80,360 acres was used for row crops, mainly corn and soybeans; 400 acres for tobacco; 15,170 acres for close-growing crops, mainly wheat; 24,805 acres for rotation hay and pasture; 36,725 acres for permanent pasture; and 3,690 acres for hay (*3*). The rest was idle cropland or was used for conservation purposes. A more recent estimate indicates that the cropland acreage has increased by about 11,000 acres, mainly in areas that were permanent pasture or woodland.

The potential of the soils in the survey area for increased production of food is fair. About 29,000 acres of potentially good cropland is currently pasture and 12,000 acres woodland. In addition to the reserve productive capacity represented by this land, food production could also be increased by extending the latest crop production technology to all of the cropland in the survey area. This soil survey can greatly facilitate the application of such technology.

Some of the acreage in the survey area has been converted from crops and pasture to land used for urban development. In 1977, an estimated 10,898 acres was urban and built-up land (*7*). The acreage used for urban development has been increasing at a rate of about 300 acres per year. This soil survey can help make land use decisions that will influence the future role of urban development and farming in the survey area.

The paragraphs that follow describe the main management needs in the areas used for crops and pasture.

Soil erosion is a major problem on about 52 percent of the cropland and pasture in the survey area. If the slope is more than 2 percent, erosion is a hazard (fig. 8).

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost or part of the subsoil is incorporated into the plow layer. Preparing a good seedbed and tilling are difficult on eroded soils because the exposed subsoil is heavier textured and less friable than the original

Figure 8.—Gully erosion on abandoned cropland. Erosion is a hazard on all of the sloping cropland in the survey area.

surface layer. Loss of the surface layer is especially damaging on soils with a fragipan, such as Cincinnati and Rossmoyne, because a fragipan limits the depth of the root zone. Many fertilizers that are applied to the soils tend to remain in the plow layer. The fertilizer may be carried away with the eroding soil. Second, soil erosion results in sediment entering streams. Control of erosion prevents the clogging of drainage ditches and the pollution of streams by sediment, fertilizers, herbicides, and pesticides and improves water quality for municipal use, for recreation, and for fish and wildlife.

Erosion control provides a protective plant cover, reduces the runoff rate, and increases the rate of infiltration. A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, where part of the acreage is pasture and hay, including legumes and grasses in the cropping system not only provides nitrogen and improves tilth for the future crops but also reduces the risk of erosion on the more sloping soils.

In some areas slopes are so short and irregular that contour farming or terracing is not practical, especially in many areas of Cincinnati and Hickory soils. On these soils a cropping system that provides a substantial vegetative cover is needed to control erosion unless conservation tillage is practiced. A no-tillage system of row cropping is effective in controlling erosion on the more sloping soils.

Diversions and parallel tile outlet terraces reduce the length of the slope and are effective in controlling sheet, rill, and gully erosion. Terracing helps to prevent excessive soil loss and the associated loss of fertilizer elements. Also, it helps to prevent sedimentation, crop damage, and damage to watercourses; tends to eliminate the need for grassed waterways, which take arable land out of row crop production; facilitates contour farming, which saves fuel; and reduces the amount of pesticides that enter watercourses. The terraces should be carefully designed so that they conform to the existing topography. The suitability for terraces is limited by a lack of long, uniform slopes and by restricted permeability.

Grassed waterways are needed in areas of the more sloping soils used as cropland. Tile drainage is commonly needed in these waterways to reduce seepiness and to maintain a good grass cover.

Grade stabilization structures are effective in preventing gully erosion. These structures help to control erosion in areas where surface water drains into an open ditch. Also, they are needed in open ditches in areas where the grade is so steep and the water moves so rapidly that erosion is a problem on the sides and bottom of the channel.

Wetness is a major problem on about 47 percent of the cropland and pasture in the survey area. The poorly drained Cobbsfork soils, extensive upland soils, have a seasonal high water table (fig. 9) and are very slowly permeable. A drainage system is needed on these soils. In many areas some type of drainage measure has been applied.

Crops in areas of somewhat poorly drained soils benefit from artificial drainage during most years. Examples are Avonburg, Bartle, Holton, and Wakeland soils.

The design of both surface and subsurface drains varies with the kind of soil. A combination of surface drains and open ditches may be needed in areas of the poorly drained Cobbsfork soils used for intensive row cropping. Drains should be more closely spaced in slowly permeable or very slowly permeable soils than in the more permeable ones. Subsurface drains may function satisfactorily in soils that have a fragipan, such as Avonburg, if they are carefully designed and installed. Subsurface drains may not function properly in areas of Cobbsfork soils because obtaining an outlet is commonly difficult. Also, pumping may be needed in conjunction with the drains. Holton and Wakeland soils can be drained satisfactorily by subsurface drains.

Flooding is a hazard on bottom land soils and in a few areas of low lying terrace soils. Most bottom land soils, such as Holton, Wakeland, and Wirt, are flooded during the winter and spring. The flooding usually does not occur during the cropping season and is of brief duration. It rarely causes substantial crop loss. Floodwater ponded in small depressional areas of Holton and Wakeland soils may delay planting in some years. Commonly, winter wheat is not planted on bottom land because of the potential for winter flooding. Dikes and levees are needed to protect bottom land soils, but constructing and maintaining them is very costly. Since most bottom land areas are small, protecting the cropland in these areas generally is not economical.

Figure 9.—A seasonal high water table at a depth of about 10 inches in Cobbsfork silt loam.

Soil fertility is naturally moderate or low in most of the upland and terrace soils in the survey area. The soils on bottom land, such as Wirt, Haymond, and Nolin, are

naturally higher in content of plant nutrients than most upland and terrace soils. They normally are neutral in reaction.

The upland and terrace soils, such as Avonburg, Cobbsfork, and Elkinsville, are naturally medium acid or strongly acid in the surface layer. Applications of ground limestone generally are needed on these soils to raise the pH level sufficiently for the crops that grow best on nearly neutral soils. The supply of available phosphorus and potash is naturally low in most of these soils. Applications of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops in the survey area have a silt loam surface layer that is low or moderate in content of organic matter. Generally, the structure of these soils is moderate or weak. Following periods of intense rainfall, a crust forms on the surface of these soils. The crust is hard when dry and is impervious to water. As a result, it reduces the rate of water infiltration and increases the runoff rate. Regularly adding crop residue, manure, and other organic material improves soil structure and helps to prevent surface crusting.

Fall plowing is generally not suitable on the light colored or moderately dark soils that have a silt loam surface layer because a crust forms in winter and spring. Also, the wetter soils tend to puddle during this period. If they are plowed in the fall, many of the soils are nearly as hard and as dense at the time of planting as they were before they were plowed. Also, the more sloping soils are subject to damaging erosion if they are plowed in the fall.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Corn and soybeans are the main row crops. Grain sorghum, sunflowers, navy beans, and similar crops can be grown if economic conditions are favorable.

Wheat is the most common close-growing crop. Oats, rye, early buckwheat, and flax can be grown, and grass seed could be produced from fescue, redtop, and bluegrass.

Specialty crops are limited in extent in the survey area, but several important crops are grown. Although tobacco is grown on only about 400 acres, this crop is economically important in the survey area (fig. 10). In the northern part of the survey area, tomatoes are grown commercially. The acreage of this crop has been declining in recent years. Deep soils that have good natural drainage and that warm up early in the spring are well suited to vegetables and small fruits. These include Cincinnati, Elkinsville, and Switzerland soils.

Most of the well drained soils are suitable for orchards and nursery crops. Soils in low lying areas where frost is frequent and air drainage is poor, however, are poorly suited to early vegetables, small fruits, and orchards.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in table 6.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects.

Figure 10.—Tobacco on Rossmoyne silt loam, 2 to 6 percent slopes, eroded.

Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 6.

Woodland Management and Productivity

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *a* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting

stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places.

Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, lovegrass, bromegrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, broom sedge, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, beech, wild cherry, sweetgum, willow, apple, black walnut, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, pondweed, spikerush, wild millet, wildrice, algae, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, woodchuck, coyote, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit

revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 11). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

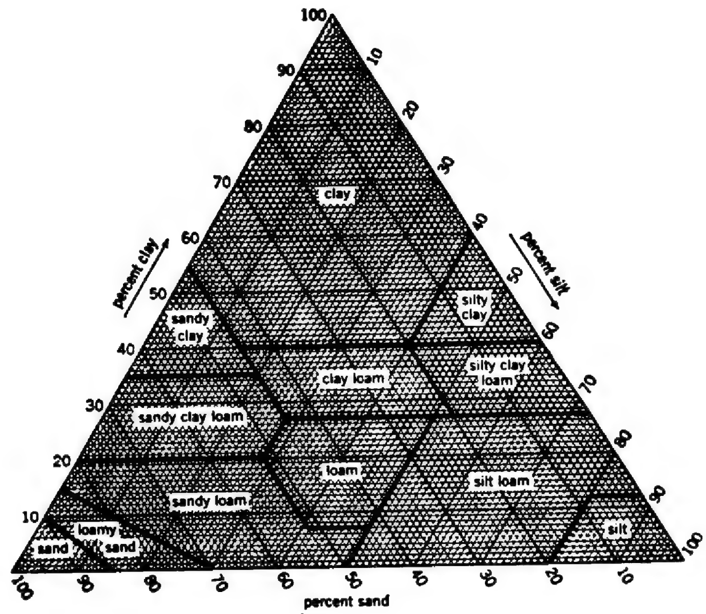


Figure 11.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in

group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of

less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare,

common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 19 shows laboratory test data for two pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Indiana State Highway Research and Training Center, Purdue University.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fragiudalfs (*Fragi*, meaning fragipan, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fragiudalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Fragiudalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*8*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*9*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Algiers Series

The Algiers series consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in recent alluvium and in the underlying older alluvium. Slopes range from 0 to 2 percent.

Algiers soils are commonly near Holton, Lobdell, and Wakeland soils. The nearby soils do not have a buried soil. Also, Holton soils have more sand than the Algiers soils.

Typical pedon of Algiers silt loam, frequently flooded, in a cultivated field; 1,025 feet east and 102 feet north of the center of sec. 24, T. 10 N., R. 12 E.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; friable; many very fine and fine roots; neutral; abrupt smooth boundary.

C—8 to 30 inches; grayish brown (10YR 5/2) silt loam; common fine faint dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; many fine roots; dark gray (10YR 4/1) krotovinas; neutral; clear smooth boundary.

2Ab—30 to 41 inches; very dark gray (10YR 3/1) loam; moderate medium subangular blocky structure; friable; common very fine roots; neutral; clear smooth boundary.

2Bbg—41 to 47 inches; very dark grayish brown (10YR 3/2) loam; few fine prominent yellowish brown (10YR 5/8) and common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure; firm; common very fine roots; very dark gray (10YR 3/1) krotovinas; neutral; gradual smooth boundary.

2Cg1—47 to 70 inches; dark gray (10YR 4/1) loam; common fine prominent yellowish brown (10YR 5/8) and many medium faint gray (10YR 5/1) mottles; weak medium prismatic structure; firm; few fine roots; about 10 percent coarse fragments 2 to 25 millimeters in size; mildly alkaline; gradual smooth boundary.

2Cg2—70 to 80 inches; grayish brown (10YR 5/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; few fine roots; about 15 percent coarse fragments 2 to 10 millimeters in size; slight effervescence; moderately alkaline.

The medium textured recent alluvium is 20 to 36 inches thick over the 2Ab horizon. It is slightly acid or neutral. The buried soil is slightly acid to mildly alkaline. The 2Cg horizon is neutral to moderately alkaline.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is silt loam or loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3 and is mottled. It is silt loam, loam, or silty clay loam. The 2Ab horizon has value of 2 or 3 and chroma of 0 or 1. It is silt loam, loam, silty clay loam, or clay loam. The 2Bbg horizon is neutral in hue or has hue of 10YR, 2.5Y, or 5Y. It has value of 4 or 5 and chroma of 0 to 2. It has few to many mottles. It is loam, silty clay loam, clay loam, or silty clay. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 to 3. It has few to many mottles. It ranges from clay loam or silty clay loam to gravelly sand.

Avonburg Series

The Avonburg series consists of deep, somewhat poorly drained, very slowly permeable soils that have a fragipan. These soils are on ridgetops in the uplands. They formed in loess and silty glacial material. Slopes range from 0 to 6 percent.

These soils have a lower base saturation than is definitive for the Avonburg series and do not have glacial till in the solum. These differences, however, do not alter the usefulness and management of the soils.

Avonburg soils are similar to Bartle soils and are commonly near Cincinnati, Cobbsfork, and Rossmoyne soils. Bartle soils do not have a fragipan and contain more sand in the lower part of the solum than the Avonburg soils. Cobbsfork soils do not have a fragipan, have dominant colors with chroma of 2 or less within the upper 10 inches of the argillic horizon, and are on the wider ridgetops. Rossmoyne and Cincinnati soils are dominantly browner in the upper 10 inches of the argillic horizon than the Avonburg soils. They are on the narrower ridgetops.

Typical pedon of Avonburg silt loam, 0 to 2 percent slopes, in a cornfield; 2,300 feet north and 320 feet west of the southeast corner of sec. 23, T. 9 N., R. 12 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; many fine and medium roots; strongly acid; abrupt smooth boundary.

BA—10 to 16 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; many fine to coarse roots; few fine black (10YR 2/1) iron and manganese oxide concretions; very strongly acid; gradual smooth boundary.

Btg—16 to 27 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine to coarse roots; thin discontinuous gray (10YR 5/1) clay films on faces of peds; few fine black (10YR 2/1) iron and manganese oxide concretions; extremely acid; gradual wavy boundary.

Btx1—27 to 34 inches; light brownish gray (10YR 6/2) silty clay loam; many coarse distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure; firm and brittle; few fine roots in vertical cracks; thin discontinuous gray (10YR 5/1) clay films on faces of prisms; thin discontinuous white (10YR 8/1 dry) silt coatings in vertical cracks; vesicular pores in interiors of peds; extremely acid; gradual wavy boundary.

Btx2—34 to 80 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish

brown (10YR 5/6) mottles; weak very coarse prismatic structure; very firm and brittle; few medium roots in vertical cracks; thin discontinuous distinct gray (10YR 5/1) clay films on faces of prisms; thin discontinuous distinct white (10YR 8/1 dry) silt coatings in vertical cracks; vesicular pores in interiors of peds; very strongly acid.

The solum is 60 to 96 inches thick. The depth to the fragipan ranges from 21 to 36 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It ranges from neutral to strongly acid. Pedons in areas that have not been cultivated have a very dark grayish brown (10YR 3/2) or dark gray (10YR 4/1) A horizon that is 2 to 4 inches thick and have an E horizon, which has hue of 10YR, value of 5 to 7, and chroma of 2 to 4. The Btg horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 6. In pedons where chroma is 3 or more, coatings on faces of peds are continuous and have chroma of 2 or less. The Btg horizon has common to many mottles. It is silt loam or silty clay loam. It ranges from strongly acid to extremely acid. The Bx horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 6 and is mottled. It is silt loam or silty clay loam. It ranges from strongly acid to extremely acid.

Bartle Series

The Bartle series consists of deep, somewhat poorly drained, very slowly permeable soils on stream terraces. These soils formed in loess and outwash sediments. Slopes range from 0 to 2 percent.

These soils do not have a fragipan, and the upper part of the subsoil is slightly browner than is definitive for the Bartle series. These differences, however, do not affect the usefulness and management of the soils.

Bartle soils are similar to Avonburg soils and are commonly near Pekin and Elkinsville soils. Avonburg soils have a fragipan and have less sand in the lower part of the solum than the Bartle soils. Pekin and Elkinsville soils have dominantly brownish colors in the argillic horizon. They are in the more sloping areas on stream terraces.

Typical pedon of Bartle silt loam, 0 to 2 percent slopes, in an area of cropland; 2,600 feet north and 1,100 feet east of the southwest corner of sec. 8, T. 9 N., R. 11 E.

Ap—0 to 9 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak very fine subangular blocky structure; friable; common fine roots; strongly acid; abrupt smooth boundary.

Bt—9 to 16 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin patchy yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btg—16 to 25 inches; light brownish gray (10YR 6/2) silt loam; many medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btx—25 to 36 inches; grayish brown (10YR 5/2) silty clay loam; common fine prominent strong brown (7.5YR 5/8) mottles; weak medium and coarse prismatic structure parting to weak thin platy; very firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; thin patchy white (10YR 8/1 dry) silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

B'tg—36 to 47 inches; grayish brown (10YR 5/2) silty clay loam; common fine prominent yellowish red (5YR 5/8) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; thin discontinuous gray (5Y 5/1) clay films on faces of peds; slightly acid; gradual smooth boundary.

2Cg—47 to 71 inches; gray (5Y 5/1) loam; common fine prominent brown (7.5YR 4/4) mottles; massive; firm; common black (10YR 2/1) iron and manganese oxide stains; slightly acid; gradual wavy boundary.

3C—71 to 80 inches; yellowish brown (10YR 5/8) stratified loam, silt loam, clay loam, and sand; common fine prominent grayish brown (10YR 5/2) mottles; massive; friable; common black (10YR 2/1) iron and manganese oxide stains; about 3 percent coarse fragments 2 to 10 millimeters in size; neutral.

The solum is 40 to 70 inches thick. The depth to the dense layer ranges from 24 to 36 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is neutral to very strongly acid. The Bt horizon has value of 5 or 6 and chroma of 2 to 6 and is mottled. It is very strongly acid or strongly acid. The Btx horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 or 2 and has brighter mottles. It is silt loam or silty clay loam. It is very strongly acid or strongly acid. The Btg horizon has hue 10YR, 2.5Y, or 5Y, value of 5 to 7, and chroma of 1 or 2 and has brighter mottles. It is silt loam or silty clay loam. It is medium acid or slightly acid. The 2C and 3C horizons have hue of 10YR, 2.5Y, or 5Y, value of 5 to 7, and chroma of 1 to 8 and are mottled. They are silt loam or silty clay loam in the upper part and are stratified in the lower part with textures ranging from sand to silty clay loam. They range from medium acid to neutral.

Bonnell Series

The Bonnell series consists of deep, well drained, slowly permeable soils on uplands. These soils formed in

a thin layer of loess and in the underlying glacial till. Slopes range from 6 to 35 percent.

Bonnell soils are similar to Carmel soils and are commonly near Cincinnati and Hickory soils. Carmel soils have less sand than the Bonnell soils. Cincinnati soils have a fragipan and are upslope from the Bonnell soils. Hickory soils have less clay in the upper 20 inches of the argillic horizon than the Bonnell soils. They are on side slopes at the higher elevations.

Typical pedon of Bonnell silt loam, 6 to 12 percent slopes, eroded, in an area of second growth woodland; 900 feet south and 1,150 feet west of the northeast corner of sec. 18, T. 6 N., R. 12 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam mixed with some yellowish brown (10YR 5/4), light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure parting to weak very fine granular; friable; common fine roots; thin discontinuous brown (10YR 5/3) organic coatings on faces of peds; neutral; gradual smooth boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/8) silt loam; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; medium acid; clear smooth boundary.

2Bt2—18 to 30 inches; brown (7.5YR 4/4) clay; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

2Bt3—30 to 42 inches; strong brown (7.5YR 5/6) clay; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin continuous brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt4—42 to 60 inches; brown (7.5YR 4/4) clay loam; weak medium prismatic structure; very firm; few fine roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; few white (10YR 8/1 dry) sand coatings in voids between peds; few fine black (10YR 2/1) iron and manganese oxide concretions; neutral; gradual smooth boundary.

2C—60 to 80 inches; yellowish brown (10YR 5/6) clay loam mixed with some brown (7.5YR 4/4); massive; very firm; common fine black (10YR 2/1) iron and manganese oxide concretions; neutral.

The thickness of the solum is 50 to 80 inches. The thickness of the loess is 3 to 18 inches. The depth to clay residuum ranges from 5 to 10 feet. The depth to free carbonates ranges from 30 to more than 80 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam or loam. It is 4 to 12 inches thick. It is strongly acid to neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is silt loam or silty clay loam. It is strongly acid to slightly acid. The 2Bt horizon has colors similar to those of the Bt horizon. It is silty clay, clay, or clay loam. It is very strongly acid to slightly acid in the upper part and medium acid to moderately alkaline in the lower part. In some pedons it has free carbonates. The thickness of the Bt horizon combined with that of the 2Bt horizon is 40 to 70 inches. The 2C horizon has value of 4 or 5 and chroma of 2 to 6. It is clay loam, loam, or silty clay. It is neutral to moderately alkaline and may have free carbonates.

Carmel Series

The Carmel series consists of deep, well drained, very slowly permeable soils in the uplands. These soils formed in loess and in the underlying shale and limestone residuum. Slopes range from 12 to 35 percent.

These soils contain more clay in the subsoil than is definitive for the Carmel series. This difference, however, does not alter the usefulness and management of the soils.

Carmel soils are similar to Bonnell soils and are commonly near Eden and Switzerland soils. Bonnell soils have more sand than the Carmel soils. Eden soils have a solum that is less than 40 inches thick. They are shallower to interbedded limestone and shale than the Carmel soils. They are in the downslope areas. Switzerland soils have a layer of loess that is thicker over residuum than that of the Carmel soils. They are in the upslope areas.

Typical pedon of Carmel silt loam, 12 to 18 percent slopes, eroded, in a wooded pasture; 1,360 feet north and 60 feet east of the southwest corner of sec. 17, T. 8 N., R. 13 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; common fine and very fine roots; neutral; clear smooth boundary.

BA—5 to 10 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine roots; thin discontinuous brown (10YR 4/3) organic coatings on faces of peds; medium acid; gradual smooth boundary.

2Bt1—10 to 19 inches; yellowish brown (10YR 5/4) clay; common fine prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous light yellowish brown (10YR 6/4) clay films on faces of peds; few fine black (10YR 2/1) iron and

manganese oxide concretions; strongly acid; gradual smooth boundary.

2Bt2—19 to 32 inches; yellowish brown (10YR 5/6) clay; moderate medium subangular blocky structure parting to moderate fine subangular blocky; firm; few fine roots; thin continuous light yellowish brown (10YR 6/4) clay films on faces of peds; many fine black (10YR 2/1) iron and manganese oxide concretions in the upper 4 inches, common fine below; slickensides 2 to 6 inches wide; neutral; clear smooth boundary.

2Bt3—32 to 40 inches; yellowish brown (10YR 5/8) clay; moderate fine subangular blocky structure; firm; few fine roots; thin discontinuous light yellowish brown (10YR 6/4) clay films on faces of peds; common fine black (10YR 2/1) iron and manganese oxide concretions; pressure faces 1 to 2 inches wide; common rounded sand grains; neutral; abrupt smooth boundary.

2C—40 to 53 inches; yellowish brown (10YR 5/6) silty clay; many medium prominent pale olive (5Y 6/3) and common fine faint yellowish brown (10YR 5/4) mottles; massive; firm; few fine roots; common fine black (10YR 2/1) iron and manganese oxide concretions; few small shale fragments; about 10 percent limestone flagstones; slight effervescence; mildly alkaline; clear smooth boundary.

Cr—53 inches; pale brown (10YR 6/3) soft interbedded silty clay and silty clay loam shale and limestone.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the loess ranges from 6 to 18 inches. The depth to calcareous shale and limestone bedrock is 40 to 60 inches.

The A horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam or silty clay loam. It is strongly acid to neutral. The 2Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay. It is very strongly acid to neutral. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 2 to 8.

Cincinnati Series

The Cincinnati series consists of deep, well drained, slowly permeable soils on uplands. These soils formed in loess, silty glacial drift, and glacial till (fig. 12). Slopes range from 2 to 18 percent.

Cincinnati soils are similar to Pekin and Rossmoyne soils and commonly are near Avonburg, Bonnell, Hickory, Rossmoyne, and Switzerland soils. Avonburg soils have dominantly low chroma colors in the subsoil. They are on the wider ridges. Bonnell and Hickory soils do not have a fragipan and contain more sand in the control section than the Cincinnati soils. They are in downslope areas. Their control section contains more sand than that of the Cincinnati soils. Pekin and Rossmoyne soils have low chroma mottles within the upper 10 inches of the argillic horizon. Rossmoyne soils are in upslope areas. Switzerland soils do not have a fragipan. They are on ridges and side slopes in downslope areas.

Figure 12.—A profile of Cincinnati silt loam, 2 to 6 percent slopes, eroded. A fragipan is marked by the lighter colored streaks in the lower part of the subsoil.

Typical pedon of Cincinnati silt loam, 6 to 12 percent slopes, eroded, in an area of pasture; 945 feet west and 120 feet north of the southeast corner of sec. 12, T. 7 N., R. 12 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam mixed with some yellowish brown (10YR 5/4), light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine roots; few fine distinct yellowish red (5YR 4/6) iron and manganese oxide stains; slightly acid; abrupt smooth boundary.

BA—7 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; firm; few fine roots; slightly acid; clear wavy boundary.

Bt—13 to 25 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

Btx1—25 to 39 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; thin patchy light brownish gray (10YR 6/2) silt coatings on faces of peds; strongly acid; gradual wavy boundary.

2Btx2—39 to 53 inches; yellowish brown (10YR 5/6) loam; common medium faint yellowish brown (10YR 5/4) mottles; moderate very coarse prismatic structure; very firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; thin discontinuous light brownish gray (10YR 6/2) silt coatings on faces of peds; strongly acid; gradual wavy boundary.

2Btx3—53 to 65 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure; very firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; thin discontinuous light brownish gray (10YR 6/2) silt coatings on faces of peds; strongly acid; gradual wavy boundary.

2Bt—65 to 80 inches; strong brown (7.5YR 5/6) clay loam; common medium faint strong brown (7.5YR 5/8) and few medium distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; few very dark brown (10YR 2/2) iron and manganese stains; neutral.

The solum is 80 to 120 inches thick. The thickness of the loess ranges from 18 to 40 inches. The depth to the fragipan ranges from 18 to 38 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is silty clay loam or silt loam. It is neutral to strongly acid. The Btx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 1 to 8. It is mottled. It is silty clay loam or silt loam. It is strongly acid or very strongly acid. The 2Btx horizon has colors similar to those of the Btx horizon. It is loam or clay loam. It is strongly acid or very strongly acid.

Cincinnati silt loam, 2 to 6 percent slopes, eroded, does not have till within a depth of 40 inches and has less clay in the control section than is definitive for the series. These differences, however, do not alter the usefulness and management of the soil.

Cobbsfork Series

The Cobbsfork series consists of deep, poorly drained, very slowly permeable soils on uplands. These soils formed in loess and silty glacial drift. Slopes range from 0 to 2 percent.

These soils have a lower base saturation than is definitive for the Cobbsfork series. This difference, however, does not alter the usefulness and management of the soils.

Cobbsfork soils are commonly near Avonburg and Rossmoyne soils. The nearby soils have a subsoil that is browner than that of the Cobbsfork soils. They are on the narrower ridgetops.

Typical pedon of Cobbsfork silt loam, in a cultivated field; 180 feet south and 30 feet west of the northeast corner of sec. 23, T. 10 N., R. 12 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few fine faint grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; friable; common fine roots; thin discontinuous white (10YR 8/1 dry) silt coatings on faces of peds; few fine black (10YR 2/1) iron and manganese oxide accumulations; few fine prominent strong brown (7.5YR 5/8) iron stains; neutral; abrupt smooth boundary.

BEg—10 to 15 inches; light gray (10YR 7/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to moderate fine granular; friable; common fine roots; thin discontinuous white (10YR 8/1 dry) silt coatings on faces of peds; few fine black (10YR 2/1) iron and manganese oxide accumulations; few fine prominent strong brown (7.5YR 5/8) iron stains; strongly acid; gradual smooth boundary.

Btg1—15 to 27 inches; light gray (10YR 7/1) silt loam; many medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6)

mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin patchy gray (10YR 6/1) clay films on faces of peds; thin discontinuous white (10YR 8/1 dry) silt coatings on faces of peds; few fine black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; gradual smooth boundary.

Btg2—27 to 36 inches; light gray (10YR 7/1) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; thin discontinuous gray (10YR 6/1) clay films on faces of peds; thin patchy white (10YR 8/1 dry) silt coatings on faces of peds; few fine black (10YR 2/1) iron and manganese oxide accumulations; extremely acid; gradual smooth boundary.

Btxg—36 to 56 inches; gray (10YR 6/1) silty clay loam; many coarse prominent strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure; firm; thin continuous gray (10YR 6/1) clay films on faces of prisms; thin patchy white (10YR 8/1 dry) silt coatings on faces of prisms; few medium black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; gradual smooth boundary.

Btx—56 to 80 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) silt loam; many coarse prominent gray (10YR 6/1) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; very firm; thin patchy white (10YR 8/1 dry) silt coatings on faces of prisms; few fine black (10YR 2/1) iron and manganese oxide accumulations; medium acid.

The thickness of the solum is 72 to more than 100 inches. The soils are medium acid to extremely acid within a depth of 40 inches, unless they have been limed. Below a depth of 40 inches, they are slightly acid to extremely acid. The thickness of the loess is 30 to 60 inches.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. In uncultivated areas the A horizon is thin and has value of 3 to 5 and chroma of 1. The E horizon, if present, has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 and is mottled. The Btg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2 and is mottled. It is silt loam or silty clay loam. The Btx horizon has hue of 2.5Y or 10YR, value of 5 to 7, and chroma of 1 to 6 and is mottled. It is silty clay loam or silt loam. The content of coarse fragments in this horizon is 1 to 5 percent.

Dearborn Series

The Dearborn series consists of deep, well drained, moderately permeable soils on bottom land (fig. 13). These soils formed in loamy and sandy alluvium. Slopes range from 0 to 2 percent.

These soils do not have a mollic epipedon and have a coarser texture in the C horizon than is definitive for the Dearborn series. These differences, however, do not alter the usefulness and management of the soils.

Dearborn soils are commonly near Stonelick and Wirt soils. The nearby soils generally are on the wider flood plains. They do not have coarse fragments within a depth of 40 inches. Also, Wirt soils do not have free carbonates within a depth of 40 inches.

Typical pedon of Dearborn fine sandy loam, frequently flooded, in a hayfield; 900 feet north and 530 feet east of the southwest corner of sec. 11, T. 6 N., R. 12 E.

Ap—0 to 10 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; many fine and medium roots; thin patchy very dark grayish brown (10YR 3/2) organic coatings on faces of peds; about 5 percent limestone fragments as much as 4 inches long; strong effervescence; mildly alkaline; clear smooth boundary.

Bw1—10 to 16 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; common fine and medium roots; about 10 percent limestone fragments as much as 6 inches long; strong effervescence; moderately alkaline; clear wavy boundary.

Bw2—16 to 24 inches; dark yellowish brown (10YR 4/4) channery sandy loam; moderate medium subangular blocky structure; friable; common fine and medium roots; about 30 percent limestone fragments as much as 6 inches long; about 5 percent rock fragments 6 to 12 inches long; strong effervescence; moderately alkaline; gradual wavy boundary.

BC—24 to 31 inches; yellowish brown (10YR 5/4) channery loamy coarse sand; weak very fine granular structure; very friable; common fine and medium roots; about 30 percent limestone fragments as much as 6 inches long; about 10 percent rock fragments 6 to 12 inches long; strong effervescence; moderately alkaline; abrupt smooth boundary.

C—31 to 60 inches; light yellowish brown (10YR 6/4) channery coarse sand; single grain; very friable; few fine and medium roots; about 30 percent limestone fragments as much as 6 inches long; about 10 percent rock fragments 6 to 12 inches long; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 56 inches. The depth to channery or flaggy material ranges from 0 to 30 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam, sandy loam, fine sandy loam, or loam or the channery or flaggy analogs of these

Figure 13.—Profile of Dearborn fine sandy loam, frequently flooded. Many coarse fragments are in the subsoil and the underlying material.

textures. The content of rock fragments in this horizon ranges from 0 to 25 percent. The Bw horizon has value of 4 or 5 and chroma of 3 to 6. It is loam, fine sandy loam, or sandy loam or the channery or flaggy analogs of these textures. The content of rock fragments in this horizon ranges from 5 to 40 percent. The C horizon has value of 4 to 6 and chroma of 3 to 6. It is channery loam, channery sandy loam, channery loamy sand, or channery sand or the very channery, gravelly, very gravelly, flaggy, or very flaggy analogs of these textures. The content of rock fragments in this horizon ranges from 30 to 80 percent.

Eden Series

The Eden series consists of moderately deep, well drained, slowly permeable soils on uplands. These soils formed in material weathered from interbedded limestone and shale. Slopes range from 18 to 50 percent.

Eden soils are commonly near Carmel and Switzerland soils. The nearby soils are more than 40 inches deep over bedrock. They are upslope from the Eden soils.

Typical pedon of Eden flaggy silty clay loam, 25 to 50 percent slopes, in an area of oak-maple timber; 980 feet east and 60 feet south of the northwest corner of sec. 17, T. 8 N., R. 13 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) flaggy silty clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; friable; many very fine to medium roots; about 15 percent limestone fragments; slightly acid; clear smooth boundary.

Bt1—3 to 8 inches; yellowish brown (10YR 5/4) silty clay; strong medium angular and subangular blocky structure; firm; common fine and medium and few coarse roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 10 percent limestone and weathered shale fragments and thin limestone flagstones; slight effervescence; neutral; gradual smooth boundary.

Bt2—8 to 21 inches; yellowish brown (10YR 5/6) flaggy silty clay; strong medium angular and subangular blocky structure; firm; common medium and few coarse roots; thin continuous yellowish brown (10YR 5/4) clay films on faces of peds; about 25 percent limestone and weathered shale fragments and limestone flagstones; slight effervescence; mildly alkaline; gradual smooth boundary.

Bt3—21 to 27 inches; dark yellowish brown (10YR 4/4) flaggy silty clay; moderate medium angular and subangular blocky structure; firm; common medium and few fine roots; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds and in root channels; about 10 percent weathered shale fragments and 20 percent limestone flagstones;

slight effervescence; mildly alkaline; clear wavy boundary.

BC—27 to 40 inches; olive yellow (2.5Y 6/6) flaggy silty clay loam; common medium prominent grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; firm; few coarse roots; about 40 percent pale olive (5Y 6/3) soft weathered calcareous shale; about 20 percent limestone flagstones; strong effervescence; mildly alkaline; gradual smooth boundary.

Cr—40 inches; pale olive (5Y 6/3) soft weathered calcareous silt loam shale with strata of thinly bedded fractured limestone; strong brown (7.5YR 5/8) silty clay around limestone and in fractures; strong effervescence; moderately alkaline.

The solum is 14 to 40 inches thick. The depth to paralithic contact ranges from 20 to 40 inches. Reaction ranges from medium acid to moderately alkaline throughout the profile.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. It is flaggy silty clay loam, flaggy silt loam, silty clay loam, or silt loam. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 3 to 6. The content of coarse fragments in this horizon ranges from 10 to 40 percent. The Cr horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 to 4. It is soft shale and limestone.

Elkinsville Series

The Elkinsville series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in loess and in the underlying acid old alluvium. Slopes range from 2 to 12 percent.

Elkinsville soils are commonly near Bartle and Pekin soils. The nearby soils have a fragipan or dense layer, are grayish in the subsoil, and are generally in the less sloping areas on the stream terraces.

Typical pedon of Elkinsville silt loam, 2 to 6 percent slopes, in a cornfield; 1,690 feet south and 1,370 feet east of the northwest corner of sec. 3, T. 6 N., R. 12 E.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

BA—9 to 15 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable; few fine roots; thin patchy faint brown (10YR 4/3) organic coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt1—15 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; few fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

2Bt2—24 to 38 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

2Bt3—38 to 50 inches; strong brown (7.5YR 5/6) clay loam; weak medium subangular blocky structure; firm; few fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

2BC—50 to 58 inches; strong brown (7.5YR 5/6) sandy clay loam; few fine faint pale brown (10YR 6/3) mottles; weak fine subangular blocky structure; friable; common patchy dark yellowish brown (10YR 4/4) iron oxide stains; medium acid; gradual smooth boundary.

2C—58 to 70 inches; yellowish brown (10YR 5/6) stratified loam and clay loam; common fine distinct pale brown (10YR 6/3) mottles; massive; friable; common distinct dark yellowish brown (10YR 4/4) iron oxide stains; medium acid.

The solum is 42 to 72 inches thick. It ranges from medium acid to very strongly acid.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam, clay loam, or silty clay loam. The C horizon has value of 4 or 5 and chroma of 4 to 6. It ranges from silt loam to clay loam and commonly is stratified with these textures.

Grayford Series

The Grayford series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying glacial till and residuum. Slopes range from 12 to 35 percent.

These soils are deeper to bedrock than is definitive for the Grayford series, have a lower base saturation, and have a higher clay content. These differences, however, do not alter the usefulness or behavior of the soils.

Grayford soils are similar to Hickory soils and are commonly near the Eden-Rock outcrop complex and Ryker soils. Hickory soils do not have residuum in the lower part. In the Eden-Rock outcrop complex, bedrock is at a depth of less than 40 inches. The complex is in downslope areas. Ryker soils have less sand in the control section than the Grayford soils. They are in upslope areas.

Typical pedon of Grayford silt loam, 18 to 35 percent slopes, in an area of woodland; 1,070 feet south and 410 feet east of the center of sec. 28, T. 9 N., R. 10 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine and medium

roots; about 1 percent chert fragments as much as 75 millimeters in size; extremely acid; clear smooth boundary.

E—3 to 9 inches; yellowish brown (10YR 5/6) silt loam; weak fine granular structure; friable; many fine and medium roots and few coarse roots; thin discontinuous dark grayish brown (10YR 4/2) organic coatings on faces of peds and in root channels; about 1 percent chert fragments as much as 75 millimeters in size; extremely acid; gradual smooth boundary.

BE—9 to 13 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; many fine and medium and few coarse roots; thin discontinuous dark grayish brown (10YR 4/2) organic coatings on faces of peds and in root channels; about 1 percent chert fragments as much as 75 millimeters in size; very strongly acid; gradual wavy boundary.

2Bt1—13 to 20 inches; strong brown (7.5YR 5/6) clay loam; moderate medium and fine subangular blocky structure; firm; many medium and fine roots; thin discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; about 2 percent chert fragments as much as 100 millimeters in size; very strongly acid; gradual smooth boundary.

2Bt2—20 to 30 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous yellowish brown (10YR 5/4) clay films on faces of peds; about 2 percent chert fragments as much as 100 millimeters in size; very strongly acid; gradual wavy boundary.

3Bt3—30 to 48 inches; red (2.5YR 4/6) clay; many coarse prominent yellowish brown (10YR 5/4) mottles; strong medium subangular blocky structure; firm; few fine roots; thick continuous yellowish brown (10YR 5/4) and red (2.5YR 4/6) clay films on faces of peds; about 15 percent chert fragments 2 to 50 millimeters in size; very strongly acid; gradual wavy boundary.

3Bt4—48 to 80 inches; reddish brown (2.5YR 4/4) clay; common coarse prominent yellowish brown (10YR 5/4) mottles; strong medium subangular blocky structure; firm; few fine roots; thick continuous red (2.5YR 4/6) and yellowish brown (10YR 5/4) clay films on faces of peds; about 15 percent chert fragments 2 to 50 millimeters in size; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches and coincides with the depth to bedrock. The thickness of the loess ranges from 6 to 24 inches. The depth to clay residuum ranges from 35 to 55 inches. Reaction is very strongly acid or extremely acid below the surface layer.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. The E horizon has value of 4 or 5 and chroma of 3 to 6. The Bt horizon, if it occurs, has value of 4 or 5 and chroma of 4 to 6. It is silt loam, loam, or silty clay loam. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is clay loam or loam. The 3Bt horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8. It is clay or silty clay. The weighted clay content of the control section generally averages more than 35 percent in areas where slopes are 18 to 35 percent and less than 35 percent in areas where slopes are 12 to 18 percent.

Haymond Series

The Haymond series consists of deep, well drained, moderately permeable soils on bottom land. These soils formed in silty and loamy alluvium. Slopes range from 0 to 2 percent.

Haymond soils are commonly near Lobdell, Wakeland, and Wirt soils. Lobdell soils have low chroma mottles within a depth of 20 inches. Wakeland soils have low chroma mottles in the horizon directly below the surface layer. Wirt soils have more sand than the Haymond soils.

Typical pedon of Haymond silt loam, frequently flooded, in an area of woodland; 1,360 feet north and 615 feet west of the southeast corner of sec. 10, T. 9 N., R. 11 E.

A—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; common fine roots; neutral; clear smooth boundary.

Bw1—6 to 21 inches; brown (10YR 5/3) silt loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few fine roots; neutral; gradual smooth boundary.

Bw2—21 to 55 inches; brown (10YR 4/3) loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few fine roots; neutral; gradual smooth boundary.

C—55 to 60 inches; dark yellowish brown (10YR 4/4) stratified loam, sandy loam, and sand; massive; friable; mildly alkaline.

The solum ranges from 30 to 60 inches in thickness. It is slightly acid or neutral to a depth of 50 inches. In some pedons the content of coarse fragments below a depth of 40 inches is, by volume, as much as 15 percent.

The A horizon has value of 3 to 5 and chroma of 2 to 4. It is slightly acid or neutral. The Bw horizon has value of 4 or 5 and chroma of 3 to 6. It is silt loam or loam. The C horizon has value of 4 or 5 and chroma of 1 to 4. It is loam or silt loam or is stratified with textures ranging from sand to silt loam.

Hickory Series

The Hickory series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a thin layer of loess and in the underlying glacial till. Slopes range from 12 to 35 percent.

Hickory soils are similar to Grayford soils and are commonly near Bonnell and Cincinnati soils. Grayford soils formed partly in residuum. They are on side slopes at the lower elevations. Bonnell soils have more clay than the Hickory soils. They are on side slopes at the lower elevations. Cincinnati soils have a fragipan and contain less sand than the Hickory soils. They are in upslope areas.

Typical pedon of Hickory silt loam, 12 to 18 percent slopes, eroded, in a fescue pasture; 820 feet north and 160 feet west of the center of sec. 25, T. 8 N., R. 12 E.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

Bt1—5 to 13 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable; common fine roots; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

2Bt2—13 to 25 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; thin continuous pale brown (10YR 6/3) silt coatings in vertical cracks; few fine black (10YR 2/1) iron and manganese oxide concretions; very strongly acid; gradual smooth boundary.

2Bt3—25 to 37 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; thin discontinuous pale brown (10YR 6/3) silt coatings in vertical cracks; common fine black (10YR 2/1) iron and manganese oxide concretions; strongly acid; gradual smooth boundary.

2Bt4—37 to 47 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin continuous light olive brown (2.5Y 5/4) and thin discontinuous prominent grayish brown (2.5Y 5/2) clay films on faces of peds; few fine strong brown (7.5YR 5/8) iron and manganese stains; common fine black (10YR 2/1) iron and manganese oxide concretions; few fine carbonate accumulations; mildly alkaline; clear smooth boundary.

2C—47 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/8) and many coarse distinct light brownish gray (10YR 6/2) mottles; massive; very firm; many fine black (10YR 2/1) iron and manganese oxide concretions and stains; common fine carbonate concretions; about 8 percent coarse fragments 2 to 19 millimeters in size; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 72 inches. The loess is less than 20 inches thick.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. Pedons in uncultivated areas have a thin A horizon, which has hue of 10YR, value of 2 to 4, and chroma of 2, and have an E horizon, which has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The Ap or A horizon is silt loam or loam and is neutral to medium acid. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. In some pedons this horizon has both high and low chroma mottles in the lower part. It is silty clay loam or silt loam and is medium acid to very strongly acid. The 2Bt horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 3 to 6 and is generally mottled. It is very strongly acid and strongly acid in the upper part and neutral to moderately alkaline in the lower part. It contains free carbonates in some pedons. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6 and has both higher and lower chroma mottles. It is clay loam or loam and is neutral to moderately alkaline. In most pedons this horizon contains free carbonates.

Holton Series

The Holton series consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in loamy and silty alluvium. Slopes range from 0 to 2 percent.

Holton soils are commonly near Algiers, Lobdell, Wakeland, and Wirt soils. Algiers soils have a buried dark surface layer beneath a layer of silty overwash. Lobdell and Wakeland soils have less sand than the Holton soils. Wirt soils have a brownish subsoil.

Typical pedon of Holton silt loam, frequently flooded, in an area of idle land; 1,050 feet east and 200 feet south of the northwest corner of sec. 29, T. 10 N., R. 13 E.

Ap—0 to 7 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak very fine granular structure; friable; many very fine roots; medium acid; gradual smooth boundary.

A—7 to 14 inches; brown (10YR 5/3) loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak

medium subangular blocky structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

BA—14 to 20 inches; grayish brown (10YR 5/2) fine sandy loam; many coarse distinct yellowish brown (10YR 5/4) and few fine prominent strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; common fine roots; medium acid; gradual smooth boundary.

Bw1—20 to 31 inches; grayish brown (10YR 5/2) fine sandy loam; many medium distinct yellowish brown (10YR 5/4) and few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots; medium acid; gradual smooth boundary.

Bw2—31 to 41 inches; grayish brown (10YR 5/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; few fine roots; medium acid; gradual smooth boundary.

C—41 to 60 inches; grayish brown (10YR 5/2) fine sandy loam; many coarse distinct dark yellowish brown (10YR 4/4) mottles; massive; very friable; slightly acid.

The control section is medium acid to neutral. The content of clay in this section ranges from 5 to 18 percent. The content of coarse fragments ranges from 0 to 10 percent in the solum and from 0 to 15 percent in the C horizon.

The A horizon has value of 4 or 5 and chroma of 2 or 3. It is silt loam or loam. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 8 and is distinctly mottled. It is sandy loam, fine sandy loam, or loam that has thin layers of loamy sand. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 6 and is distinctly mottled. It is loam, fine sandy loam, or sandy loam. It is medium acid to neutral.

Lobdell Series

The Lobdell series consists of deep, moderately well drained, moderately permeable soils on bottom land. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Lobdell soils are commonly near Algiers, Haymond, Holton, Wakeland, and Wirt soils. Algiers soils have a buried dark surface layer at a depth of 20 to 40 inches. Haymond and Wirt soils are well drained. Holton and Wakeland soils have dominantly low chroma colors within a depth of 20 inches. Also, Holton soils have a higher sand content than the Lobdell soils.

Typical pedon of Lobdell silt loam, frequently flooded, in an idle field; 2,560 feet north and 370 feet east of the southwest corner of sec. 6, T. 7 N., R. 13 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; common fine roots; neutral; gradual smooth boundary.

Bw—8 to 27 inches; brown (10YR 5/3) silt loam; few fine faint light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; few fine roots; common dark yellowish brown (10YR 4/4) iron oxide stains; common black (10YR 2/1) iron and manganese oxide accumulations; neutral; gradual smooth boundary.

C1—27 to 52 inches; pale brown (10YR 6/3) loam; common fine faint light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; many dark yellowish brown (10YR 4/4) iron and manganese oxide stains and accumulations; neutral; clear smooth boundary.

C2—52 to 60 inches; grayish brown (10YR 5/2) gravelly sandy clay loam; common fine faint yellowish brown (10YR 5/4) mottles; massive; friable; many black (10YR 2/1) iron and manganese oxide stains and accumulations; about 25 percent coarse fragments 2 to 25 millimeters in size; neutral.

Reaction is medium acid to neutral to a depth of 40 inches. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bw and C horizons generally have value of 4 to 6 and chroma of 3 to 5. They are dominantly silt loam or loam. Mottles with chroma of 2 or less are within a depth of 20 inches. In some pedons the part of the C horizon below a depth of 40 inches has chroma of 2 or less. It is silt loam, loam, clay loam, sandy clay loam, sandy loam, loamy sand, or the gravelly analogs of these textures.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils on bottom land. These soils formed in silty and loamy alluvium. Slopes range from 0 to 2 percent.

Nolin soils are commonly near Stonelick and Wirt soils. The nearby soils have more sand than the Nolin soils. Also, Stonelick soils have free carbonates throughout.

Typical pedon of Nolin silt loam, frequently flooded, in an area of pasture; 2,060 feet south and 655 feet east of the northwest corner of sec. 13, T. 6 W., R. 12 E.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; many fine roots; thin discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; neutral; clear smooth boundary.

Bw1—7 to 29 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure parting to

moderate medium and fine subangular blocky; friable; common fine roots; thin continuous brown (10YR 4/3) organic coatings on faces of peds; mildly alkaline; gradual smooth boundary.

Bw2—29 to 55 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots in the upper part grading to few fine roots in the lower part; thin continuous dark grayish brown (10YR 4/2) organic coatings on faces of peds; neutral; gradual smooth boundary.

Bw3—55 to 80 inches; dark yellowish brown (10YR 4/4) loam; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) organic coatings on faces of peds; few small pockets of sandy loam and loam; slightly acid.

The solum ranges from 60 to more than 100 inches in thickness. It is slightly acid to mildly alkaline.

The Ap horizon is silt loam or silty clay loam. It has value of 4 or 5 and chroma of 2 or 3. In pedons where it appears to be dark, the A horizon has value of more than 3 when rubbed. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silt loam in the upper part and loam or clay loam in the lower part. In some pedons it has mottles with chroma of 2 or 3 in the lower part.

Pekin Series

The Pekin series consists of deep, moderately well drained, very slowly permeable soils on stream terraces. These soils formed in loess and in the underlying glacial sediments. Slopes range from 2 to 6 percent.

These soils have more clay in the lower part of the subsoil and in the underlying material than is definitive for the Pekin series. This difference, however, does not alter the usefulness and management of the soils.

Pekin soils are similar to Cincinnati and Rossmoyne soils and are commonly near Bartle and Elkinsville soils. Cincinnati and Rossmoyne soils do not have outwash sediments in the underlying material and have a fragipan that is thicker than that of the Pekin soils. Bartle soils are dominantly grayish in the subsoil and do not have a fragipan. They are in the less sloping areas on the stream terraces. Elkinsville soils do not have a fragipan and are browner in the upper 10 inches of the argillic horizon than the Pekin soils. Their positions on the stream terraces are similar to those of the Pekin soils.

Typical pedon of Pekin silt loam, 2 to 6 percent slopes, eroded, in a cornfield; 2,385 feet west and 330 feet south of the northeast corner of sec. 14, T. 6 N., R. 12 E.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam mixed with some yellowish brown (10YR 5/6), pale brown (10YR 6/3) dry; weak very fine granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Bt1—8 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; weak medium subangular blocky structure; friable; common fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—15 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct light brownish gray (10YR 6/2) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

Btx1—23 to 41 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; weak very coarse prismatic structure; very firm; common black (10YR 2/1) and red (2.5YR 4/6) iron and manganese oxide concretions; very strongly acid; gradual wavy boundary.

Btx2—41 to 54 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; weak very coarse prismatic structure; very firm; many black (10YR 2/1) and red (2.5YR 4/6) iron and manganese oxide concretions; very strongly acid; gradual wavy boundary.

2Btx3—54 to 68 inches; strong brown (7.5YR 5/8) clay; many medium prominent light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure; firm; thin discontinuous gray (N 5/0) clay films in pores; common black (10YR 2/1) and red (2.5YR 4/6) iron and manganese oxide concretions; strongly acid; gradual smooth boundary.

2C—68 to 80 inches; light brownish gray (2.5Y 6/2) clay; common fine prominent strong brown (7.5YR 5/8) mottles; massive; firm; thin strata of loam and clay loam; medium acid.

The solum is 40 to 70 inches thick. It is medium acid to very strongly acid. The depth to the fragipan is 20 to 38 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 4 to 6. In the lower part it has few to many mottles with chroma of 2 or less. It is silt loam or silty clay loam. The Btx horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 8 and is mottled. It is dominantly silt loam or silty clay loam. In some pedons, however, it is clay, silty clay, or clay loam in the lower part. The 2C horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 8. It is silty clay or clay. It is medium acid to neutral.

Rossmoyne Series

The Rossmoyne series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess and silty glacial drift. Slopes range from 0 to 6 percent.

These soils do not have glacial till within a depth of 40 inches and have less clay in the control section than is definitive for the Rossmoyne series. These differences, however, do not alter the usefulness and management of the soils.

Rossmoyne soils are similar to Cincinnati and Pekin soils and are commonly near Avonburg and Cincinnati soils. Avonburg soils are dominantly grayish in the subsoil. They are on the wider ridgetops. Cincinnati soils do not have mottles with chroma of 2 or less within the upper 10 inches of the argillic horizon. They are on the narrower ridgetops and on side slopes. Pekin soils have outwash sediments in the underlying material.

Typical pedon of Rossmoyne silt loam, 2 to 6 percent slopes, eroded, in a pastured area; 220 feet east and 1,650 feet north of the southwest corner of sec. 12, T. 9 N., R. 12 E.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam mixed with some light yellowish brown (10YR 6/4), pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; many very fine and fine roots; medium acid; abrupt smooth boundary.

Bt1—9 to 14 inches; light yellowish brown (10YR 6/4) silt loam; moderate fine subangular blocky structure; friable; common very fine roots; thin patchy light yellowish brown (10YR 6/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—14 to 23 inches; yellowish brown (10YR 5/6) silt loam; common fine prominent light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; firm; thin continuous pale brown (10YR 6/3) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—23 to 28 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent light gray (10YR 7/2) and few medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; thin continuous light brownish gray (10YR 6/2) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btx1—28 to 36 inches; light gray (10YR 6/1) silt loam; many fine prominent yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; thin discontinuous gray (10YR 5/1) clay films on faces of prisms; thin patchy white (10YR 8/1 dry) silt coatings on faces of prisms; strongly acid; gradual smooth boundary.

Btx2—36 to 51 inches; light gray (10YR 6/1) silty clay loam; many medium prominent yellowish red (5YR 5/6) mottles; weak very coarse prismatic structure; very firm; thin patchy white (10YR 8/1 dry) silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Btx3—51 to 80 inches; light gray (10YR 6/1) silt loam; many coarse prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very firm; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; very strongly acid.

The solum is 60 to 120 inches thick. The thickness of the loess ranges from 18 to 60 inches. The depth to the fragipan ranges from 18 to 38 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6 and has mottles with chroma of 2 or less within the upper 10 inches. It is silty clay loam or silt loam and is medium acid to very strongly acid. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6 and is mottled. It is silty clay loam or silt loam and is strongly acid or very strongly acid.

Ryker Series

The Ryker series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying glacial till and limestone residuum. Slopes range from 6 to 12 percent.

Ryker soils are similar to Grayford soils and are commonly near Cincinnati and Grayford soils. Grayford soils have more sand in the control section than the Ryker soils. They are in downslope areas. Cincinnati soils do not have residuum in the lower part. They are at the higher elevations.

Typical pedon of Ryker silt loam, 6 to 12 percent slopes, eroded, in a pastured area; 1,730 feet west and 2,305 feet south of the northeast corner of sec. 4, T. 7 N., R. 10 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam mixed with some yellowish brown (10YR 5/4), light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 11 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable; common fine roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—11 to 22 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—22 to 33 inches; yellowish brown (10YR 5/6) silt loam; weak medium prismatic structure parting to

moderate medium subangular blocky; firm; few fine roots; thin discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; thin discontinuous light gray (10YR 7/2 dry) silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

2Bt4—33 to 53 inches; strong brown (7.5YR 5/8) loam; weak medium prismatic structure parting to moderate fine subangular blocky; firm; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; thin discontinuous light gray (10YR 7/2 dry) silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

3Bt5—53 to 80 inches; red (2.5YR 4/8) clay; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular and subangular blocky; firm; thin continuous red (2.5YR 4/8) clay films on faces of peds; strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches and coincides with the depth to bedrock. The thickness of the loess ranges from 20 to 40 inches. The depth to limestone residuum ranges from 48 to 80 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam or silty clay loam. It ranges from very strongly acid to neutral. Pedons in uncultivated areas have a thin A horizon, which has hue of 10YR, value of 3 or 4, and chroma of 2 or 3, and may have an E horizon, which has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has value of 4 or 5 and chroma of 6 to 8. It is silt loam or silty clay loam. It is neutral to strongly acid in the upper part and medium acid to very strongly acid in the lower part. The 2Bt horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 6 to 8. It is loam or clay loam. It is strongly acid or very strongly acid. The 3Bt horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8. It is clay, silty clay, or silty clay loam and is strongly acid or very strongly acid.

Stonelick Series

The Stonelick series consists of deep, well drained, moderately rapidly permeable soils on bottom land. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Stonelick soils are similar to Wirt soils and are commonly near Dearborn, Nolin, and Wirt soils. Dearborn soils have many coarse fragments within the control section. They are on the narrower flood plains. Nolin and Wirt soils do not have free carbonates within a depth of 40 inches. Also, Nolin soils have a cambic horizon.

Typical pedon of Stonelick loam, frequently flooded, in a cornfield; 1,895 feet south and 900 feet east of the northwest corner of sec. 3, T. 6 N., R. 12 E.

Ap—0 to 9 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; thin discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; about 5 percent coarse fragments 2 to 10 millimeters in size; slight effervescence; moderately alkaline; clear smooth boundary.

C1—9 to 25 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; few fine roots; thin patchy dark brown (10YR 3/3) organic coatings on faces of peds; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—25 to 31 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak very fine granular structure; friable; few fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C3—31 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; single grain; very friable; few fine roots; thin strata of loamy fine sand and fine sand 2 to 4 inches thick; strong effervescence; moderately alkaline.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. Organic coatings that have darker colors are in some pedons. The part of the C horizon within a depth of 40 inches has value of 4 or 5 and chroma of 3 or 4. It is loam, sandy loam, or fine sandy loam that has thin strata of sandy loam, fine sandy loam, loamy sand, loamy fine sand, or silt loam. The part of the C horizon below a depth of 40 inches has value of 4 or 5 and chroma of 3 to 6. It is loam, fine sandy loam, or loamy fine sand and commonly is stratified with these textures. It becomes coarser textured with increasing depth.

Switzerland Series

The Switzerland series consists of deep, well drained soils on uplands. These soils formed in loess and in the underlying shale and limestone residuum. Permeability is moderate in the upper part of the profile and very slow in the lower part. Slopes range from 6 to 18 percent.

These soils do not have the strongly contrasting textures in the lower part of the subsoil that are definitive for the Switzerland series. This difference, however, does not alter the usefulness and management of the soils.

Switzerland soils are commonly near Carmel, Cincinnati, and Eden soils. Carmel soils have a layer of loess that is less than 18 inches thick. They are in downslope areas. Cincinnati soils have a fragipan. They are in upslope areas. Eden soils have bedrock at a depth of 40 inches or less. They are in downslope areas.

Typical pedon of Switzerland silt loam, 6 to 12 percent slopes, eroded, in an area of woodland; 370 feet east and 180 feet south of the northwest corner of sec. 31, T. 8 N., R. 13 E.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam mixed with some yellowish brown (10YR 5/4), pale brown (10YR 6/3) dry; weak very fine granular structure; friable; many fine roots; strongly acid; abrupt smooth boundary.

Bt1—7 to 19 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; common fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—19 to 28 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine and medium roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt3—28 to 37 inches; yellowish brown (10YR 5/4) silty clay; moderate medium subangular blocky structure; firm; few fine and medium roots; thin discontinuous dark yellowish brown (10YR 4/4) and light olive brown (2.5Y 5/4) clay films on faces of peds; few fine black (10YR 2/1) iron and manganese oxide concretions; strongly acid; gradual smooth boundary.

2Bt4—37 to 53 inches; yellowish brown (10YR 5/4) silty clay; weak medium prismatic structure parting to moderate medium angular and subangular blocky; firm; few fine and medium roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds and in root channels; thin patchy light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine black (10YR 2/1) iron and manganese oxide concretions and stains; strongly acid; gradual smooth boundary.

2Bt5—53 to 64 inches; yellowish brown (10YR 5/6) silty clay; common medium prominent light brownish gray (2.5Y 6/2) mottles; weak fine prismatic structure parting to weak coarse angular and subangular blocky; very firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few black (10YR 2/1) oxide stains; neutral; abrupt smooth boundary.

2Cr—64 inches; soft interbedded shale and limestone; strong effervescence.

The thickness of the solum ranges from 40 to 70 inches. The thickness of the loess ranges from 20 to 36 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is neutral to strongly acid. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam and ranges from medium acid to very strongly acid. The 2Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 8. It is silty clay or clay. It is medium acid to very strongly acid in the upper part and moderately alkaline to slightly acid in the lower part. Some pedons have a C horizon, which is silty clay, clay, or flaggy clay, has hue of 10YR to 5Y, value of 5 to 7, and chroma of 3 to 6, and is moderately alkaline.

Wakeland Series

The Wakeland series consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in silty and loamy alluvium. Slopes range from 0 to 2 percent.

Wakeland soils are commonly near Algiers, Haymond, Holton, Lobdell, and Wirt soils. Algiers soils have a buried mollic epipedon at a depth of 20 to 40 inches. Haymond, Lobdell, and Wirt soils are browner than the Wakeland soils. Also, Holton soils have a higher sand content.

Typical pedon of Wakeland silt loam, frequently flooded, in an area of idle land; 2,120 feet west and 110 feet north of the southeast corner of sec. 25, T. 8 N., R. 12 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; many fine roots; medium acid; clear smooth boundary.

C—6 to 13 inches; pale brown (10YR 6/3) silt loam; many fine faint light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; common fine roots; few fine yellowish brown (10YR 5/8) iron and manganese oxide stains; slightly acid; gradual smooth boundary.

Cg1—13 to 30 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct brown (10YR 5/3) mottles; weak medium platy structure; few fine roots; common medium yellowish brown (10YR 5/8) iron and manganese oxide stains; few fine black (10YR 2/1) iron and manganese oxide concretions; neutral; clear smooth boundary.

Cg2—30 to 43 inches; light brownish gray (10YR 6/2) silt loam; many coarse distinct brown (10YR 5/3) mottles; massive; friable; few fine roots; common medium yellowish brown (10YR 5/8) iron and manganese oxide stains; few fine black (10YR 2/1) iron and manganese oxide concretions; neutral; gradual smooth boundary.

Cg3—43 to 60 inches; yellowish brown (10YR 5/4) stratified loam, sandy loam, and clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; strong effervescence in the lower part; neutral grading to moderately alkaline in the lower part.

The control section is medium acid to neutral. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The part of the C horizon within a depth of 30 inches has value of 4 to 6 and chroma of 1 to 4 and is mottled. The part below a depth of 30 inches is silt loam or loam or is stratified with textures ranging from sand to clay loam.

Wirt Series

The Wirt series consists of deep, well drained, moderately permeable soils on bottom land. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Wirt soils are commonly near Dearborn, Haymond, Holton, Lobdell, Nolin, Stonelick, and Wakeland soils. Stonelick soils are less well developed than the Wirt soils and have free carbonates within a depth of 40 inches. Haymond, Lobdell, Nolin, and Wakeland soils have less sand than the Wirt soils. Dearborn soils are shallower to limestone fragments and free carbonates than the Wirt soils. Holton soils are mottled in the horizon directly below the surface layer.

Typical pedon of Wirt silt loam, frequently flooded, in an alfalfa field; 1,600 feet east and 530 feet north of the southwest corner of sec. 8, T. 8 N., R. 12 E.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bw1—9 to 30 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; common fine roots; neutral; gradual smooth boundary.

Bw2—30 to 49 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 10 percent coarse fragments 2 to 30 millimeters in size; neutral.

The solum ranges from 30 to 50 inches in thickness. It is medium acid to neutral to a depth of 40 inches. Free carbonates do not occur within a depth of 40 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is silt loam or loam and is medium acid to neutral. The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loam, sandy loam, or fine sandy loam and is medium acid to neutral. The C horizon has value of 3 to 5 and chroma of 3 to 6. It is loam, sandy loam, fine sandy loam, loamy sand, sand, or gravelly sand. It is medium acid to moderately alkaline. In some pedons the content of coarse fragments below a depth of 40 inches is, by volume, as much as 35 percent.

Formation of the Soils

This section relates the major factors of soil formation to the soils in the survey area. It also describes many of the processes of soil formation.

Factors of Soil Formation

Soils form through the physical and chemical weathering of deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the others.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the chemical and mineralogical composition of the soil. The parent material of most of the soils in the survey area is of glacial origin or is material weathered from local bedrock. These materials were reworked and redeposited by subsequent action of wind and water. The properties of these materials may vary greatly, sometimes within a small area, depending on how the materials were deposited. The dominant parent materials in the survey area were deposited as loess, silty glacial drift, glacial till, glacial outwash, residuum, and alluvium.

Loess is silty material that was blown from bottom land and dry lakebeds and deposited on adjacent uplands by strong northwesterly winds. This material covers almost all the uplands in the survey area. The thickness of the material ranges from about 3 feet on nearly level ridgetops to less than 1 foot on the steeper side slopes. Unweathered loess is calcareous and friable and is mainly silt. Cobbsfork and Cincinnati soils are examples of soils formed partly in loess. These soils are typically medium textured and have a strongly expressed structure.

Silty glacial drift is silty material of unknown age. It has only recently been recognized, and little is known about its origin or its method of deposition. This silty material is closely associated with the loess which overlies it and is commonly called "gritty loess." It generally is between depths of 3 and 8 feet, beneath the loess and over the glacial till on stable ridgetops. It is mostly silt and has developed into very firm, dense layers in several of the upland soils. Cobbsfork, Avonburg, Rossmoyne, and Cincinnati soils are examples of soils that formed partly in silty glacial drift.

Glacial till is a mixture of stones, sand, silt, and clay. Large glaciers of Illinoian age brought this material into the survey area from areas farther north. When the ice receded, about 150,000 years ago, a mantle of glacial till remained over the bedrock. This material is exposed on many upland side slopes in the survey area. Bonnell and Hickory soils are examples of soils that formed in glacial till.

Glacial outwash was deposited by running water from melting glaciers. The particles that make up outwash material vary in size according to the velocity of the water that carried them. When rapidly moving water slows down, the coarser particles are deposited. The finer particles, such as very fine sand, silt, and clay, can be carried by the more slowly moving water and tend to be deposited farther from the stream channel. Because of this sorting action, outwash deposits generally occur as layers of particles that are similar in size, such as silt, sand, or gravel. In the survey area these deposits are on stream terraces along the major drainageways. Because most of the outwash deposits have been covered by a blanket of loess, the soils in these areas formed in both the loess and the outwash material. Bartle soils are an example.

Residuum is material weathered from local bedrock. The nature of the bedrock determines the chemical and mineralogical characteristics of the soils that form in it.

Generally, more time is needed for soils to form in bedrock residuum than in other kinds of parent material because the bedrock does not break down easily. The bedrock in the survey area is sedimentary rock of Ordivician and Silurian age. It is interbedded limestone and shale and is exposed on the steeper side slopes along the more deeply entrenched drainageways. Bedrock of Ordivician age is mostly shale that has thin layers of limestone (fig. 14). It is generally in the eastern part of the survey area. Bedrock of Silurian age is mostly limestone that has thin layers of shale. It is generally in the western part of the survey area. Eden soils are an example of soils that formed in material weathered from Ordivician bedrock. Grayford soils are an example of soils in which the lower horizons formed in material weathered from Silurian bedrock.

Alluvium is material that has been washed from upland areas and deposited by floodwater on the flood plains along streams and drainageways. The texture of the material varies, depending on the source and the speed of the water from which the material was deposited. Alluvium from areas that are dominantly loess tends to be silty and has less sand than alluvium from areas of glacial till. Because alluvial material has been deposited for a relatively short time, soils that form in alluvium have not been greatly altered by weathering. Stonelick and Wakeland soils are examples of soils that formed in alluvium.

Climate

Climate affects the kind of plant and animal life on and in the soil. It determines the amount of water available for the weathering of minerals and the transporting of soil materials. Through its influence on soil temperature, it determines the rate of chemical reaction in the soil.

The climate in the survey area generally is temperate and humid. It is presumably similar to the climate that existed when the soils formed. It is uniform throughout the survey area, but its effect is modified locally by runoff and aspect. Only minor differences among the soils in the survey area are the result of differences in climate. Detailed information about the climate is available under the heading "General Nature of the Survey Area."

Plant and Animal Life

Plants and animals influence soil formation by adding carbon and nitrogen to the soil. The kind of organic matter on and in the soil depends on the kinds of plants that grow on the soil. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. The roots of the plants provide channels for the downward movement of water through the soil, bring plant nutrients from the lower part of the profile to the upper part, and add organic matter as they decay. Bacteria in the soil help to break down the organic matter into plant nutrients.

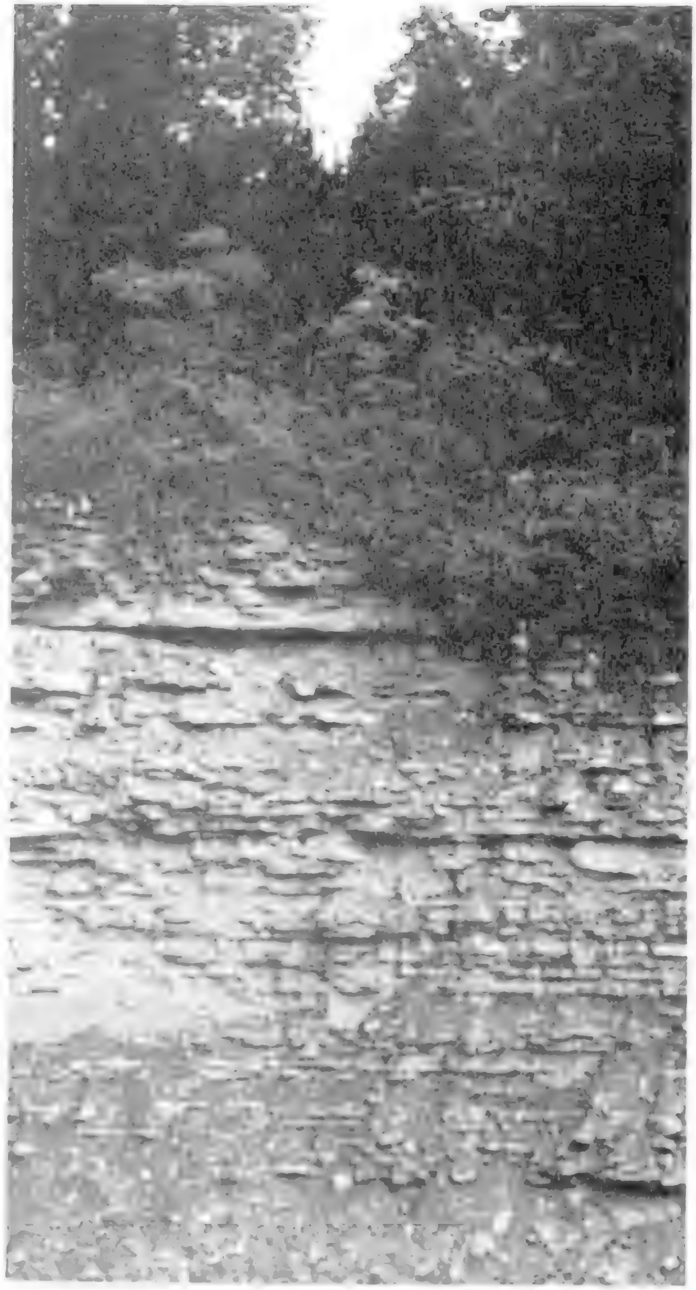


Figure 14.—Interbedded limestone and shale of Ordivician age.

The native vegetation in the survey area was mainly hardwoods. The soils that formed under forest vegetation generally have less organic matter than the soils that formed under grass. Because the vegetation was fairly uniform throughout the survey area when the soils formed, major differences among soils are not the result of differences in vegetation.

Relief

Relief or topography has markedly affected the soils in the survey area through its effect on runoff, natural drainage, erosion, plant cover, and soil temperature. Slopes range from 0 to more than 50 percent. Natural soil drainage ranges from well drained on most side slopes to poorly drained on many wide ridgetops. Through its effect on aeration, drainage determines the color of the soil. The runoff rate is most rapid on the steeper slopes and slowest in low areas where water is temporarily ponded. Water and air move freely through well drained soils but move slowly through poorly drained soils. Well aerated soils are reddish or brownish because the iron compounds that give most soils their color are oxidized. Poorly aerated soils generally are gray because of the removal or reduction of iron compounds. Cincinnati and Hickory soils are an example of well drained and well aerated soils, and Cobbsfork soils are an example of poorly drained and poorly aerated soils.

Time

Time, usually a long time, is needed for the development of distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected by the degree of profile development. Some soils form rapidly; others, slowly.

The soils in the survey area range from young to mature. The loess deposits in which many of the soils formed have been exposed to soil-forming factors long enough for the development of distinct horizons. Some soils that formed in recent alluvial sediments, however, have not been in place long enough for the development of distinct horizons.

Haymond soils are an example of young soils that formed in recently deposited alluvial material. Only the surface layer of these soils has formed. The material below the surface layer has few distinct subhorizons, and its physical and chemical properties are almost the same as when it was deposited. Rossmoyne soils are an example of mature soils. The soil-forming processes have been active for a sufficient time to alter the original parent material of these soils. The profile has distinct horizons that have slightly different properties than the horizons above and below them. Parent material in its original form is not evident within the upper 8 feet.

Processes of Soil Formation

Several processes were involved in the formation of the soils in the survey area. These processes are the accumulation of organic matter; the solution, transfer, and reprecipitation of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils more than one of these processes has been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all of the soils in the survey area. Because the native vegetation was forest, the organic matter content of the soils is not high. It is generally moderate in uneroded areas.

Carbonates and bases have been leached from the upper horizons of nearly all of the soils. Only a few young alluvial soils, which originally washed from residual limestone, retain carbonates in the upper horizons. Leaching probably precedes the translocation of silicate clay minerals. It is indicated by the absence of carbonates and by an acid reaction. In the wet soils it is slower than in well drained soils because of a high water table and the movement of water through the profile.

Clay-sized particles form in the soil when larger particles naturally break down because of the forces of weathering. Clay particles are moved downward in the profile by water. These particles accumulate in pores and other voids, and clay films form on the surfaces along which water moves. As a result, most soils have a higher clay content in the subsoil than in the surface layer. Bonnell soils are an example of soils in which translocated silicate clays have accumulated in the Bt horizon in the form of clay films.

The reduction and transfer of iron, a process called gleying, has occurred in all of the somewhat poorly drained and poorly drained soils in the survey area. This process has significantly differentiated the horizons in naturally wet soils. The subsoil of these soils generally is gray, indicating the redistribution of iron oxides. Reduction is commonly accompanied by some transfer of the iron from upper horizons either to the lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate the segregation of iron.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A

claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a

short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. Includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an overdry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-76 at Greensburg, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	38.1	19.1	28.6	66	-17	21	2.61	1.23	3.74	5	4.4
February---	42.3	22.3	32.3	67	-11	40	2.60	1.04	3.84	5	3.3
March------	51.4	29.9	40.7	78	5	170	3.67	1.70	5.27	7	3.6
April------	64.6	40.4	52.5	84	19	379	4.14	2.18	5.74	9	.2
May--------	73.9	49.2	61.6	90	26	670	4.62	2.42	6.41	8	.0
June-------	82.4	58.1	70.3	95	39	909	3.99	2.41	5.40	7	.0
July-------	85.6	61.1	73.3	96	44	1,032	4.23	2.29	5.82	7	.0
August-----	84.4	58.7	71.6	96	43	980	2.86	1.28	4.14	5	.0
September--	78.6	52.3	65.5	95	31	765	2.86	1.20	4.19	6	.0
October----	67.8	41.0	54.4	88	18	446	2.35	1.15	3.32	5	.0
November---	52.1	31.3	41.7	77	6	121	3.05	1.68	4.16	6	2.0
December---	40.9	23.0	32.0	67	-10	62	2.90	1.04	4.37	5	3.1
Yearly:											
Average--	63.5	40.5	52.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	99	-19	---	---	---	---	---	---
Total----	---	---	---	---	---	5,595	39.88	34.04	45.82	75	16.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-76 at Greensburg, Indiana]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 26	May 11	May 21
2 years in 10 later than--	April 21	May 5	May 15
5 years in 10 later than--	April 11	April 23	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	October 13	October 2	September 20
2 years in 10 earlier than--	October 18	October 7	September 25
5 years in 10 earlier than--	October 28	October 16	October 6

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-76 at Greensburg, Indiana]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	180	151	132
8 years in 10	186	159	139
5 years in 10	199	175	153
2 years in 10	212	190	167
1 year in 10	219	198	174

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP FOR SPECIFIED USES

Map unit	Extent of area	Cultivated farm crops	Specialty crops	Woodland	Urban uses	Intensive recreation areas	Extensive recreation areas
	Pct						
1. Cobbsfork-Avonburg----------	45	Good--------	Poor: wetness.	Good--------	Poor: wetness, ponding.	Poor: wetness, ponding.	Good.
2. Cincinnati-Rossmoyne-Hickory--	45	Good--------	Fair: slope.	Good--------	Fair: slow permeability, slope.	Good--------	Good.
3. Eden-Carmel-Switzerland-------	10	Poor: slope.	Poor: slope.	Good--------	Poor: slope.	Good--------	Good.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Ripley County	Jennings County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
Ag	Algiers silt loam, frequently flooded----------------------	969	0	969	0.3
AvA	Avonburg silt loam, 0 to 2 percent slopes------------------	25,203	1,475	26,678	9.0
AvB2	Avonburg silt loam, 2 to 6 percent slopes, eroded----------	13,231	277	13,508	4.6
BaA	Bartle silt loam, 0 to 2 percent slopes--------------------	873	0	873	0.3
BeC2	Bonnell silt loam, 6 to 12 percent slopes, eroded----------	463	0	463	0.2
BeD3	Bonnell silt loam, 12 to 18 percent slopes, severely eroded	925	0	925	0.3
BeE	Bonnell silt loam, 18 to 35 percent slopes-----------------	1,031	0	1,031	0.3
CbD2	Carmel silt loam, 12 to 18 percent slopes, eroded----------	2,867	0	2,867	1.0
CbE	Carmel silt loam, 18 to 35 percent slopes------------------	1,413	0	1,413	0.5
CcB2	Cincinnati silt loam, 2 to 6 percent slopes, eroded--------	11,840	8	11,848	4.0
CcC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded-------	20,657	707	21,364	7.2
CcC3	Cincinnati silt loam, 6 to 12 percent slopes, severely eroded--	12,328	596	12,924	4.4
CcD2	Cincinnati silt loam, 12 to 18 percent slopes, eroded------	1,467	5	1,472	0.5
Cm	Cobbsfork silt loam--	76,856	2,216	79,072	26.9
Dr	Dearborn fine sandy loam, frequently flooded---------------	822	0	822	0.3
EdE	Eden flaggy silty clay loam, 18 to 25 percent slopes-------	1,793	0	1,793	0.6
EdF	Eden flaggy silty clay loam, 25 to 50 percent slopes-------	9,367	0	9,367	3.2
EkB	Elkinsville silt loam, 2 to 6 percent slopes---------------	1,090	0	1,090	0.4
EkC2	Elkinsville silt loam, 6 to 12 percent slopes, eroded------	399	0	399	0.1
ErF	Eden-Rock outcrop complex, 25 to 50 percent slopes---------	2,146	128	2,274	0.8
GrD2	Grayford silty clay loam, 12 to 18 percent slopes, eroded	3,043	171	3,214	1.1
GrE	Grayford silt loam, 18 to 35 percent slopes----------------	3,376	161	3,537	1.2
Hd	Haymond silt loam, frequently flooded----------------------	1,121	0	1,121	0.4
HkD2	Hickory silt loam, 12 to 18 percent slopes, eroded---------	8,138	68	8,206	2.8
HkD3	Hickory silt loam, 12 to 18 percent slopes, severely eroded	3,507	28	3,535	1.2
HkE	Hickory loam, 18 to 35 percent slopes----------------------	16,783	393	17,176	5.8
Hn	Holton silt loam, frequently flooded-----------------------	4,442	154	4,596	1.6
Lb	Lobdell silt loam, frequently flooded----------------------	1,023	2	1,025	0.3
No	Nolin silt loam, frequently flooded------------------------	484	0	484	0.2
PeB2	Pekin silt loam, 2 to 6 percent slopes, eroded-------------	1,590	12	1,602	0.5
Pt	Pits, Quarry---	182	0	182	0.1
RoA	Rossmoyne silt loam, 0 to 2 percent slopes-----------------	3,686	3	3,689	1.2
RoB2	Rossmoyne silt loam, 2 to 6 percent slopes, eroded---------	36,156	1,444	37,600	12.7
RyC2	Ryker silt loam, 6 to 12 percent slopes, eroded------------	1,455	235	1,690	0.6
St	Stonelick loam, frequently flooded-------------------------	275	0	275	0.1
SwC2	Switzerland silt loam, 6 to 12 percent slopes, eroded------	3,103	0	3,103	1.0
SwD2	Switzerland silt loam, 12 to 18 percent slopes, eroded-----	693	0	693	0.2
Wa	Wakeland silt loam, frequently flooded---------------------	2,649	13	2,662	0.9
Wr	Wirt loam, flaggy clay substratum, frequently flooded------	2,848	235	3,083	1.0
Wt	Wirt silt loam, frequently flooded-------------------------	3,811	0	3,811	1.3
	Water areas less than 40 acres in size-----------------	596	0	596	0.2
	Water areas more than 40 acres in size-----------------	2,090	43	2,133	0.7
	Total---	286,791	8,374	295,165	100.0

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Ag----------------------- Algiers	IIw	110	35	---	3.5	6.5
AvA---------------------- Avonburg	IIw	110	38	50	3.6	7.2
AvB2--------------------- Avonburg	IIe	100	35	45	3.3	6.6
BaA---------------------- Bartle	IIw	110	38	50	3.6	7.2
BeC2--------------------- Bonnell	IIIe	90	27	32	3.4	7.0
BeD3--------------------- Bonnell	VIe	---	---	---	2.5	5.0
BeE---------------------- Bonnell	VIe	---	---	---	---	4.0
CbD2--------------------- Carmel	IVe	75	23	30	2.1	4.2
CbE---------------------- Carmel	VIe	---	---	---	1.8	3.6
CcB2--------------------- Cincinnati	IIe	105	30	45	4.5	9.0
CcC2--------------------- Cincinnati	IIIe	100	30	40	4.5	9.0
CcC3--------------------- Cincinnati	IVe	90	20	35	4.0	8.0
CcD2--------------------- Cincinnati	IVe	90	25	35	4.0	8.0
Cm----------------------- Cobbsfork	IIIw	110	35	35	3.6	7.2
Dr----------------------- Dearborn	IIIs	70	25	25	2.8	5.5
EdE---------------------- Eden	VIe	---	---	---	---	---
EdF---------------------- Eden	VIIe	---	---	---	---	---
EkB---------------------- Elkinsville	IIe	120	42	48	4.0	8.0
EkC2--------------------- Elkinsville	IIIe	105	37	42	3.4	6.8
ErF---------------------- Eden-Rock outcrop	VIIe	---	---	---	---	---
GrD2--------------------- Grayford	IVe	95	30	35	2.8	5.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
GrE----------------------- Grayford	VIe	---	---	---	2.0	4.0
Hd------------------------ Haymond	IIw	110	39	42	3.7	8.0
HkD2---------------------- Hickory	IVe	72	23	26	2.7	5.2
HkD3---------------------- Hickory	VIe	---	---	---	2.5	5.0
HkE----------------------- Hickory	VIe	---	---	---	2.4	4.8
Hn------------------------ Holton	IIIw	75	26	32	3.0	6.4
Lb------------------------ Lobdell	IIw	100	34	34	4.0	8.0
No------------------------ Nolin	IIw	85	32	---	3.0	6.0
PeB2---------------------- Pekin	IIe	95	33	43	3.1	6.2
Pt**. Pits						
RoA----------------------- Rossmoyne	IIw	110	35	40	4.5	9.0
RoB2---------------------- Rossmoyne	IIe	100	30	35	4.0	8.0
RyC2---------------------- Ryker	IIIe	110	37	43	3.5	7.0
St------------------------ Stonelick	IIw	95	32	42	4.0	7.4
SwC2---------------------- Switzerland	IIIe	80	28	36	2.6	5.2
SwD2---------------------- Switzerland	IVe	65	23	29	2.1	4.2
Wa------------------------ Wakeland	IIw	115	40	46	4.4	8.8
Wr------------------------ Wirt	IIw	75	26	32	3.2	6.4
Wt------------------------ Wirt	IIw	95	32	42	4.0	7.4

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I:				
Ripley County	---	---	---	---
Jennings County	---	---	---	---
II:				
Ripley County	106,910	63,907	42,181	822
Jennings County	3,469	1,741	1,728	---
III:				
Ripley County	116,272	34,215	82,057	---
Jennings County	3,380	1,010	2,370	---
IV:				
Ripley County	23,905	23,905	---	---
Jennings County	800	800	---	---
V:				
Ripley County	---	---	---	---
Jennings County	---	---	---	---
VI:				
Ripley County	25,321	25,321	---	---
Jennings County	554	554	---	---
VII:				
Ripley County	11,513	11,513	---	---
Jennings County	128	128	---	---
VIII:				
Ripley County	---	---	---	---
Jennings County	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Ag: Algiers	2a	Slight	Slight	Slight	Slight	Northern red oak	76	Eastern white pine, black cherry, white ash, yellow-poplar, red pine, white oak, northern red oak, green ash, black locust, American sycamore, eastern cottonwood.
						White oak	---	
						Black walnut	---	
						White ash	---	
						Sugar maple	---	
						Black cherry	---	
						Yellow-poplar	---	
AvA, AvB2: Avonburg	3d	Slight	Slight	Moderate	Moderate	White oak	70	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
						Northern red oak	75	
						Pin oak	85	
						Yellow-poplar	85	
						Sweetgum	80	
BaA: Bartle	3a	Slight	Slight	Slight	Slight	White oak	75	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak	85	
						Yellow-poplar	85	
						Sweetgum	80	
BeC2: Bonnell	2c	Slight	Moderate	Slight	Slight	Northern red oak	76	Yellow-poplar, eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
						Yellow-poplar	90	
						Shortleaf pine	80	
						Virginia pine	80	
BeD3: Bonnell	3r	Moderate	Severe	Moderate	Slight	Northern red oak	66	Virginia pine, shortleaf pine, loblolly pine.
						Shortleaf pine	70	
						Virginia pine	70	
BeE: Bonnell	2r	Moderate	Severe	Slight	Slight	Northern red oak	76	Yellow-poplar, eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
						Yellow-poplar	90	
						Shortleaf pine	80	
						Virginia pine	80	
CbD2: Carmel	1c	Slight	Slight	Severe	Severe	Northern red oak	86	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
						Yellow-poplar	98	
						Virginia pine	---	
						Shortleaf pine	---	
						Eastern white pine	---	
						Sweetgum	---	
CbE: Carmel	1r	Moderate	Moderate	Severe	Severe	Northern red oak	86	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
						Yellow-poplar	98	
						Virginia pine	---	
						Shortleaf pine	---	
						Eastern white pine	---	
						Sweetgum	---	
CcB2, CcC2, CcC3: Cincinnati	2d	Slight	Slight	Moderate	Moderate	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						White oak	---	
						Black walnut	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
						Yellow-poplar	---	
CcD2: Cincinnati	2r	Moderate	Moderate	Moderate	Moderate	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						White oak	---	
						Black walnut	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
						Yellow-poplar	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Cm: Cobbsfork	1w	Slight	Severe	Moderate	Moderate	Pin oak Yellow-poplar American beech Red maple Sweetgum	100 --- --- --- ---	American sycamore, eastern cottonwood, green ash, pin oak, red maple, silver maple, swamp white oak, sweetgum.
Dr: Dearborn	2f	Slight	Moderate	Slight	Slight	Yellow-poplar Sweetgum White ash	90 --- ---	Black walnut, eastern cottonwood, sweetgum, yellow-poplar, white ash, eastern white pine, shortleaf pine.
EdE: Eden	3r	Moderate	Moderate	Moderate	Moderate	Black oak White oak White ash Scarlet oak Black walnut Eastern redcedar	75 62 70 73 --- 40	Eastern redcedar, white oak, black oak, white ash, eastern white pine, eastern redcedar.
EdF: Eden	3r	Severe	Severe	Moderate	Moderate	Black oak White oak White ash Scarlet oak Black walnut Eastern redcedar	75 62 70 73 --- 40	Eastern redcedar, white oak, black oak, white ash, eastern white pine, eastern redcedar.
EkB, EkC2: Elkinsville	1a	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
ErF*:								
Eden	3r	Severe	Severe	Moderate	Moderate	Black oak White oak White ash Scarlet oak Black walnut Eastern redcedar	75 62 70 73 --- 40	Eastern redcedar, white oak, black oak, white ash, eastern white pine, eastern redcedar.
Rock outcrop.								
GrD2: Grayford	1a	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
GrE: Grayford	1r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Hd: Haymond	1a	Slight	Slight	Slight	Slight	Yellow-poplar White oak Black walnut	100 90 70	Eastern white pine, black walnut, yellow-poplar, black locust.
HkD2, HkD3: Hickory	1a	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak Green ash Bitternut hickory Yellow-poplar	86 85 --- --- --- 95	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.
HkE: Hickory	1r	Moderate	Moderate	Slight	Slight	White oak Northern red oak Black oak Green ash Bitternut hickory Yellow-poplar	86 85 --- --- --- 95	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	
Hn------------------ Holton	2a	Slight	Slight	Slight	Slight	Pin oak------------- Northern red oak---- Yellow-poplar------- Sugar maple--------- White oak----------- Black walnut-------- Black cherry-------- White ash-----------	85 80 90 80 --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, red pine, white ash, white oak.
Lb------------------ Lobdell	1a	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Sugar maple--------- White ash----------- White oak----------- Black cherry--------	87 96 --- --- --- ---	Eastern white pine, white oak, yellow-poplar, white ash, red pine, northern red oak.
No------------------ Nolin	1w	Slight	Moderate	Slight	Slight	Sweetgum------------ Cherrybark oak------ Eastern cottonwood-- River birch--------- Black willow-------- American sycamore---	92 97 --- --- --- ---	Sweetgum, black walnut.
PeB2---------------- Pekin	3a	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Virginia pine------- Sugar maple---------	70 85 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.
RoA, RoB2----------- Rossmoyne	2d	Slight	Slight	Moderate	Moderate	Northern red oak---- White oak----------- White ash----------- Sugar maple--------- Slippery elm-------- American beech------ American sycamore---	80 61 --- --- --- --- ---	White ash, Virginia pine, yellow-poplar, eastern white pine, black oak.
RyC2---------------- Ryker	1a	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
St------------------ Stonelick	2a	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Black walnut-------- Black cherry-------- Sugar maple--------- White ash----------- Yellow-poplar-------	80 --- --- --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak.
SwC2, SwD2---------- Switzerland	1a	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------ White oak----------- Sweetgum------------	86 98 --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
Wa------------------ Wakeland	2a	Slight	Slight	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine-------	90 88 90 85	Eastern white pine, baldcypress, American sycamore, red maple, white ash.
Wr------------------ Wirt	2a	Slight	Slight	Slight	Slight	American elm-------- Boxelder------------ Northern red oak---- Yellow-poplar------- Green ash----------- Black walnut--------	--- --- 82 90 --- ---	Black walnut, yellow-poplar, eastern white pine.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Wt------------------ Wirt	1a	Slight	Slight	Slight	Slight	Yellow-poplar--------	95	Eastern white pine, black walnut, yellow-poplar, black locust.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ag----------------- Algiers	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce------	Eastern white pine, pin oak.
AvA, AvB2---------- Avonburg	---	Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
BaA---------------- Bartle	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
BeC2, BeD3, BeE--- Bonnell	---	Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
CbD2, CbE---------- Carmel	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
CcB2, CcC2, CcC3, CcD2-------------- Cincinnati	---	Eastern redcedar, Washington hawthorn, Tatarian honeysuckle, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Austrian pine, osageorange.	Pin oak, eastern white pine.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Cm----------------- Cobbsfork	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn, Norway spruce.	Eastern white pine	Pin oak.
Dr----------------- Dearborn	---	Siberian peashrub, Tatarian honeysuckle.	Nannyberry viburnum, white spruce, northern white-cedar, Washington hawthorn, eastern redcedar.	Black willow------	Eastern cottonwood.
EdE, EdF. Eden					
EkB, EkC2--------- Elkinsville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
ErF*: Eden.					
Rock outcrop.					
GrD2, GrE---------- Grayford	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Hd----------------- Haymond	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
HkD2, HkD3, HkE--- Hickory	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Hn----------------- Holton	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Austrian pine, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Lb----------------- Lobdell	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Pin oak, eastern white pine.
No----------------- Nolin	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Pin oak, eastern white pine.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
PeB2: Pekin	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Pt*. Pits					
RoA, RoB2: Rossmoyne	---	Washington hawthorn, Amur honeysuckle, Amur privet, Tatarian honeysuckle, eastern redcedar, arrowwood, American cranberrybush.	Austrian pine, osageorange, green ash.	Pin oak, eastern white pine.	---
RyC2: Ryker	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
St: Stonelick	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, eastern redcedar, osageorange, northern white-cedar, nannyberry viburnum, white spruce, Washington hawthorn.	Black willow	---
SwC2, SwD2: Switzerland	---	Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
Wa: Wakeland	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush, silky dogwood.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	---	Eastern white pine, pin oak.
Wr: Wirt	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, northern white-cedar, white fir, Washington hawthorn, blue spruce.	Norway spruce	Eastern white pine, pin oak.
Wt: Wirt	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ag: Algiers	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: flooding, wetness.	Severe: flooding.
AvA, AvB2: Avonburg	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
BaA: Bartle	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
BeC2: Bonnell	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
BeD3: Bonnell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
BeE: Bonnell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
CbD2, CbE: Carmel	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
CcB2: Cincinnati	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
CcC2, CcC3: Cincinnati	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CcD2: Cincinnati	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Cm: Cobbsfork	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
Dr: Dearborn	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
EdE: Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.
EdF: Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
EkB: Elkinsville	Slight	Slight	Moderate: slope.	Slight	Slight.
EkC2: Elkinsville	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
ErF*:					
Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Rock outcrop.					
GrD2 Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
GrE Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Hd Haymond	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
HkD2, HkD3 Hickory	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
HkE Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Hn Holton	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Lb Lobdell	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
No Nolin	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
PeB2 Pekin	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Pt*. Pits					
RoA Rossmoyne	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
RoB2 Rossmoyne	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
RyC2 Ryker	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
St Stonelick	Severe: flooding.	Moderate: flooding, small stones.	Severe: small stones, flooding.	Moderate: flooding.	Severe: flooding.
SwC2 Switzerland	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
SwD2 Switzerland	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Wa--------------------- Wakeland	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: flooding, wetness.	Severe: flooding.
Wr, Wt----------------- Wirt	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Ag: Algiers	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AvA: Avonburg	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AvB2: Avonburg	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BaA: Bartle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BeC2: Bonnell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BeD3: Bonnell	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BeE: Bonnell	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CbD2, CbE: Carmel	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CcB2: Cincinnati	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CcC2, CcC3: Cincinnati	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CcD2: Cincinnati	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Cm: Cobbsfork	Good	Good	Fair	Good	Good	Good	Good	Fair	Good	Good.
Dr: Dearborn	Good	Good	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
EdE: Eden	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
EdF: Eden	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
EkB: Elkinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EkC2: Elkinsville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ErF*: Eden	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
GrD2: Grayford	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GrE: Grayford	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Hd------------------ Haymond	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
HkD2, HkD3---------- Hickory	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HkE----------------- Hickory	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Hn------------------ Holton	Good	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Lb------------------ Lobdell	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
No------------------ Nolin	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Fair	Very poor.
PeB2---------------- Pekin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Pt*. Pits										
RoA----------------- Rossmoyne	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
RoB2---------------- Rossmoyne	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RyC2---------------- Ryker	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
St------------------ Stonelick	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
SwC2---------------- Switzerland	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
SwD2---------------- Switzerland	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Wa------------------ Wakeland	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Wr, Wt-------------- Wirt	Good	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ag---------------- Algiers	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
AvA, AvB2--------- Avonburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
BaA--------------- Bartle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BeC2-------------- Bonnell	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
BeD3, BeE--------- Bonnell	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
CbD2, CbE--------- Carmel	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
CcB2-------------- Cincinnati	Moderate: dense layer, wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Severe: low strength, frost action.	Slight.
CcC2, CcC3-------- Cincinnati	Moderate: dense layer, wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
CcD2-------------- Cincinnati	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Cm---------------- Cobbsfork	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Dr---------------- Dearborn	Moderate: large stones, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
EdE, EdF---------- Eden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
EkB--------------- Elkinsville	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
EkC2-------------- Elkinsville	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
ErF*:						
Eden---------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Rock outcrop.						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
GrD2, GrE---------- Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Hd---------------- Haymond	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
HkD2, HkD3--------- Hickory	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
HkE---------------- Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Hn---------------- Holton	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
Lb---------------- Lobdell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
No---------------- Nolin	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
PeB2--------------- Pekin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength, frost action.	Slight.
Pt*. Pits						
RoA---------------- Rossmoyne	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
RoB2--------------- Rossmoyne	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
RyC2--------------- Ryker	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
St---------------- Stonelick	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
SwC2--------------- Switzerland	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Severe: shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
SwD2--------------- Switzerland	Severe: slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Wa---------------- Wakeland	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
Wr, Wt------------- Wirt	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ag------------------ Algiers	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
AvA----------------- Avonburg	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
AvB2---------------- Avonburg	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BaA----------------- Bartle	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
BeC2---------------- Bonnell	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
BeD3, BeE----------- Bonnell	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
CbD2, CbE----------- Carmel	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
CcB2---------------- Cincinnati	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
CcC2, CcC3---------- Cincinnati	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
CcD2---------------- Cincinnati	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Cm------------------ Cobbsfork	Severe: ponding, percs slowly.	Slight-----------	Severe: ponding.	Severe: ponding.	Poor: ponding.
Dr------------------ Dearborn	Severe: flooding.	Severe: flooding.	Severe: flooding, large stones.	Severe: flooding.	Poor: large stones.
EdE----------------- Eden	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey.
EdF----------------- Eden	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EkB----------------- Elkinsville	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
EkC2---------------- Elkinsville	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
ErF*: Eden---------------	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey.
Rock outcrop.					
GrD2, GrE----------- Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hd------------------ Haymond	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
HkD2, HkD3---------- Hickory	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
HkE----------------- Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hn------------------ Holton	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: large stones, wetness.
Lb------------------ Lobdell	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
No------------------ Nolin	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey.
PeB2---------------- Pekin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Pt*. Pits					
RoA----------------- Rossmoyne	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
RoB2---------------- Rossmoyne	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
RyC2---------------- Ryker	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
St------------------ Stonelick	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: seepage.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SwC2----------------- Switzerland	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
SwD2----------------- Switzerland	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Wa------------------- Wakeland	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Wr------------------- Wirt	Severe: flooding, percs slowly.	Severe: seepage, flooding.	Severe: flooding.	Severe: flooding, seepage.	Fair: thin layer.
Wt------------------- Wirt	Severe: flooding.	Severe: seepage, flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ag------------------- Algiers	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AvA, AvB2------------ Avonburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
BaA------------------ Bartle	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BeC2----------------- Bonnell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BeD3----------------- Bonnell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
BeE------------------ Bonnell	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
CbD2, CbE------------ Carmel	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
CcB2----------------- Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
CcC2, CcC3----------- Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
CcD2----------------- Cincinnati	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Cm------------------- Cobbsfork	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Dr------------------- Dearborn	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
EdE------------------ Eden	Poor: thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.
EdF------------------ Eden	Poor: slope, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.
EkB------------------ Elkinsville	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
EkC2----------------- Elkinsville	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
ErF*:				
Eden	Poor: slope, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.
Rock outcrop.				
GrD2 Grayford	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
GrE Grayford	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hd Haymond	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
HkD2, HkD3 Hickory	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
HkE Hickory	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hn Holton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
Lb Lobdell	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
No Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
PeB2 Pekin	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Pt*. Pits				
RoA, RoB2 Rossmoyne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
RyC2 Ryker	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
St Stonelick	Good	Probable	Improbable: too sandy.	Poor: small stones.
SwC2 Switzerland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
SwD2 Switzerland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Wa Wakeland	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wr Wirt	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Wt Wirt	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ag: Algiers	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
AvA: Avonburg	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
AvB2: Avonburg	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
BaA: Bartle	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
BeC2, BeD3, BeE: Bonnell	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
CbD2, CbE: Carmel	Severe: slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, large stones, erodes easily.	Slope, erodes easily.
CcB2: Cincinnati	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily, rooting depth.	Erodes easily, rooting depth.
CcC2, CcC3, CcD2: Cincinnati	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
Cm: Cobbsfork	Slight	Severe: piping, ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, rooting depth.
Dr: Dearborn	Severe: seepage.	Severe: piping, large stones, seepage.	Severe: no water.	Deep to water	Large stones, droughty, soil blowing.	Large stones, droughty.
EdE, EdF: Eden	Moderate: depth to rock.	Moderate: hard to pack, thin layer, large stones.	Severe: no water.	Deep to water	Slope, percs slowly, large stones.	Slope, large stones, percs slowly.
EkB: Elkinsville	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
EkC2: Elkinsville	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
ErF*: Eden	Moderate: depth to rock.	Moderate: hard to pack, thin layer, large stones.	Severe: no water.	Deep to water	Slope, percs slowly, large stones.	Slope, large stones, percs slowly.
Rock outcrop.						
GrD2, GrE: Grayford	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Hd----------------- Haymond	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
HkD2, HkD3, HkE--- Hickory	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Hn----------------- Holton	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, large stones, frost action.	Large stones, erodes easily, wetness.	Large stones, wetness, erodes easily.
Lb----------------- Lobdell	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
No----------------- Nolin	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
PeB2--------------- Pekin	Moderate: seepage, slope.	Severe: piping.	Severe: slow refill.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
Pt*. Pits						
RoA---------------- Rossmoyne	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Erodes easily, rooting depth.
RoB2--------------- Rossmoyne	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
RyC2--------------- Ryker	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
St----------------- Stonelick	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy-------	Droughty.
SwC2, SwD2--------- Switzerland	Severe: slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Wa----------------- Wakeland	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Wr----------------- Wirt	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable-------	Favorable.
Wt----------------- Wirt	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ag---------------- Algiers	0-30	Silt loam--------	ML	A-4	0	100	90-100	80-95	70-85	30-40	4-10
	30-80	Silty clay loam, loam, clay loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	80-95	70-85	30-45	7-19
AvA, AvB2--------- Avonburg	0-10	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	95-100	75-95	20-30	2-10
	10-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	75-95	30-45	10-20
	27-80	Silty clay loam, silt loam.	CL	A-6, A-7	0-3	95-100	95-100	90-100	70-95	30-45	10-20
BaA--------------- Bartle	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	5-15
	9-25	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	25-36	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	36-80	Silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
BeC2, BeD3, BeE-- Bonnell	0-18	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-90	25-35	4-12
	18-42	Silty clay, clay, clay loam.	CH	A-7	0	100	100	90-100	75-95	50-65	30-40
	42-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	20-30
	60-80	Clay loam, loam	CL	A-6, A-7	0-10	95-100	90-100	85-95	60-80	35-50	20-30
CbD2, CbE--------- Carmel	0-5	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-97	25-40	1-15
	5-10	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	25-45	10-20
	10-53	Clay, silty clay	CH	A-7	0-10	100	100	90-100	75-97	50-65	30-40
	53	Weathered bedrock	---	---	---	---	---	---	---	---	---
CcB2, CcC2, CcC3, CcD2------------ Cincinnati	0-7	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	7-25	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	25-39	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	6-20
	39-65	Clay loam, loam	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	5-20
	65-80	Clay loam, loam	CL, CL-ML	A-6, A-4	0	90-100	80-100	70-95	55-85	25-40	5-20
Cm---------------- Cobbsfork	0-10	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	90-100	70-90	15-30	3-10
	10-36	Silt loam, silty clay loam.	CL, ML, CL-ML	A-4	0	100	100	90-100	70-95	15-30	3-10
	36-80	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	75-95	20-35	5-15
Dr---------------- Dearborn	0-10	Loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0-10	90-95	85-95	70-95	55-85	25-40	5-20
	10-24	Channery sandy loam, sandy loam, loam.	CL, SC, SM	A-6, A-7, A-4	0-20	85-90	75-90	65-90	45-80	30-45	10-20
	24-60	Channery sandy loam, channery loamy sand, channery coarse sand.	CL-ML, CL, GC, SC, SM	A-4, A-6, A-2, A-1	25-50	65-75	50-75	50-75	30-60	25-40	4-15
EdE, EdF---------- Eden	0-3	Flaggy silty clay loam.	ML, CL, MH, CH	A-7, A-6	25-40	75-95	70-95	70-95	65-95	35-65	12-35
	3-40	Flaggy silty clay, flaggy clay, silty clay.	MH, CH, CL	A-7	10-45	75-100	70-100	65-100	65-95	45-75	20-45
	40	Weathered bedrock	---	---	---	---	---	---	---	---	---

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EkB, EkC2-------- Elkinsville	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	9-24	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	100	85-100	65-90	30-40	8-18
	24-58	Silty clay loam, loam, sandy clay loam.	CL	A-4, A-6	0	100	100	80-100	50-90	30-40	8-18
	58-70	Stratified silty clay loam to sandy loam.	CL, CL-ML, ML, SM	A-4, A-6	0	100	100	70-100	45-80	<30	NP-15
ErF*: Eden------------	0-6	Silty clay loam	ML, CL, MH, CH	A-7, A-6	0-15	85-100	80-100	75-100	70-100	35-65	12-35
	6-34	Flaggy silty clay, flaggy clay, silty clay.	MH, CH, CL	A-7	10-45	75-100	70-100	65-100	65-95	45-75	20-45
	34	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
GrD2------------- Grayford	0-6	Silty clay loam	CL-ML, CL	A-4	0	100	100	90-100	70-90	18-30	4-10
	6-33	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	95-100	95-100	80-95	25-35	8-13
	33-53	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0-5	95-100	85-100	75-100	60-95	25-40	8-15
	53-80	Clay, silty clay	CH, CL	A-7	0-10	95-100	65-95	60-90	50-85	45-55	20-30
GrE-------------- Grayford	0-9	Silt loam--------	CL-ML, CL	A-4	0	100	100	90-100	70-90	18-30	4-10
	9-30	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0-5	95-100	85-100	75-100	60-95	25-40	8-15
	30-80	Clay, silty clay	CH, CL	A-7	0-10	95-100	65-95	60-90	50-85	45-55	20-30
Hd--------------- Haymond	0-6	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	6-55	Silt loam, loam	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	55-60	Fine sandy loam, silt loam, loam.	ML, SM	A-4	0	95-100	90-100	80-100	35-90	27-36	4-10
HkD2, HkD3, HkE-- Hickory	0-13	Silt loam--------	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	13-47	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	47-60	Clay loam, sandy loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20
Hn--------------- Holton	0-7	Silt loam--------	CL, CL-ML, ML	A-4	0-20	90-100	85-100	80-100	60-90	<25	2-10
	7-41	Fine sandy loam, loam, loamy sand.	CL-ML, CL, SM-SC, SC	A-4, A-2, A-6	0-20	90-100	85-100	60-95	30-75	<25	4-12
	41-60	Stratified loamy fine sand to sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-2, A-6	0-40	75-100	60-100	55-90	30-55	<25	2-14
Lb--------------- Lobdell	0-8	Silt loam--------	ML, CL-ML, CL	A-4	0	95-100	90-100	80-100	65-90	20-30	NP-8
	8-52	Loam, silt loam	ML	A-4	0	90-100	80-100	70-95	55-85	20-35	NP-10
	52-60	Stratified sandy loam to silt loam.	ML, SM, CL-ML, CL	A-4	0	90-100	80-100	65-85	40-80	15-35	NP-10
No--------------- Nolin	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	7-55	Silt loam, silty clay loam, clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
	55-80	Loam, silt loam	ML, CL, CL-ML	A-4, A-6	0-10	50-100	50-100	40-95	35-95	<30	NP-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
PeB2----------- Pekin	0-8	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-30	5-15
	8-23	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-100	25-40	10-20
	23-54	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	88-98	65-90	25-35	5-15
	54-80	Clay, silty clay	CH	A-7	0	100	100	90-100	85-95	50-65	30-40
Pt*. Pits											
RoA, RoB2-------- Rossmoyne	0-9	Silt loam---------	ML	A-4	0	90-100	90-100	90-100	85-100	30-40	4-10
	9-28	Silty clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	90-100	90-100	85-100	75-95	30-48	8-20
	28-80	Silt loam, silty clay loam.	CL	A-6, A-4	0	90-100	85-95	80-90	70-85	25-40	9-19
RyC2----------- Ryker	0-22	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	90-100	80-95	20-30	5-15
	22-53	Silt loam, clay loam, loam.	CL	A-6	0	100	100	90-100	75-95	25-40	10-15
	53-80	Silty clay, clay	CL	A-6, A-7	0	85-100	80-100	60-100	30-80	25-45	10-20
St-------------- Stonelick	0-9	Loam-------------	ML, CL, SM, CL-ML	A-4	0	85-100	70-100	60-95	45-90	20-32	2-10
	9-60	Stratified loam to loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-b	0	85-100	70-95	40-60	5-40	<15	NP
SwC2, SwD2------- Switzerland	0-7	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	80-100	20-40	5-15
	7-28	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	25-45	15-25
	28-64	Silty clay, clay	CL, CH	A-7	0	95-100	90-100	85-100	75-95	45-65	25-40
	64	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wa-------------- Wakeland	0-43	Silt loam---------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	43-60	Stratified sandy loam to clay loam.	ML, CL, SM, SC	A-4, A-6, A-2	0	100	100	60-100	30-80	16-38	3-15
Wr-------------- Wirt	0-9	Loam-------------	ML, CL-ML	A-4	0	90-100	80-100	65-95	50-90	<21	NP-6
	9-40	Loam, sandy loam, fine sandy loam.	CL, CL-ML, SM, SM-SC	A-4	0	85-100	80-100	55-90	35-80	<25	NP-9
	40-49	Loamy sand, gravelly loamy sand.	SM, SP-SM	A-1	0	70-100	60-90	30-50	10-25	<20	NP-3
	49-60	Flaggy clay------	CH, CL	A-7	5-10	90-100	90-100	80-100	75-90	40-60	15-30
Wt-------------- Wirt	0-9	Silt loam---------	CL-ML, ML	A-4	0	95-100	90-100	80-100	65-90	<25	3-7
	9-49	Sandy loam, loam	CL-ML, ML	A-4	0	95-100	90-100	75-100	55-90	<25	3-7
	49-60	Stratified sandy loam to sand.	SM, SM-SC, ML, CL-ML	A-4, A-2	0	95-100	90-100	50-70	5-55	<25	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cm3	In/hr	In/in	pH					Pct
Ag---------------- Algiers	0-30	15-27	1.20-1.45	0.6-2.0	0.16-0.20	6.1-7.3	Low-----------	0.37	5	6	2-4
	30-80	20-35	1.25-1.65	0.6-2.0	0.16-0.20	6.1-7.8	Low-----------	0.37			
AvA, AvB2--------- Avonburg	0-10	10-18	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.43	4	5	.5-1
	10-27	22-30	1.35-1.50	0.6-2.0	0.18-0.20	4.0-5.5	Moderate------	0.43			
	27-80	22-30	1.60-1.85	<0.06	0.06-0.08	4.0-5.5	Moderate------	0.43			
BaA--------------- Bartle	0-9	15-26	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	4	5	1-3
	9-25	22-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43			
	25-36	22-35	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43			
	36-80	22-35	1.40-1.60	0.2-0.6	0.11-0.13	5.1-7.3	Low-----------	0.43			
BeC2, BeD3, BeE--- Bonnell	0-18	15-25	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	5	.5-3
	18-42	40-60	1.50-1.70	0.06-0.2	0.09-0.13	4.5-6.0	High----------	0.32			
	42-60	27-40	1.45-1.60	0.2-0.6	0.10-0.14	5.1-6.5	Moderate------	0.32			
	60-80	27-40	1.45-1.60	0.2-0.6	0.08-0.15	6.1-8.4	Moderate------	0.32			
CbD2, CbE--------- Carmel	0-5	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	4	6	1-4
	5-10	25-40	1.40-1.60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.43			
	10-53	50-60	1.55-1.75	<0.06	0.09-0.11	4.5-7.3	High----------	0.32			
	53	---	---	---	---	---	--------------	----			
CcB2, CcC2, CcC3, CcD2------------ Cincinnati	0-7	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	4-3	6	.5-3
	7-25	22-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Low-----------	0.37			
	25-39	24-35	1.60-1.85	0.06-0.6	0.08-0.12	4.5-6.5	Moderate------	0.37			
	39-65	24-40	1.55-1.75	0.06-0.6	0.08-0.12	4.5-6.5	Moderate------	0.37			
	65-80	24-40	1.55-1.75	0.06-0.6	0.08-0.12	6.1-7.8	Moderate------	0.37			
Cm---------------- Cobbsfork	0-10	8-18	1.30-1.60	0.06-0.2	0.22-0.24	4.5-7.3	Low-----------	0.37	4	5	1-3
	10-36	8-22	1.30-1.60	0.06-0.2	0.20-0.22	4.0-6.5	Low-----------	0.37			
	36-80	15-28	1.40-1.85	<0.06	0.06-0.12	4.5-6.0	Low-----------	0.37			
Dr---------------- Dearborn	0-10	20-30	1.30-1.45	0.6-2.0	0.17-0.21	7.4-8.4	Low-----------	0.37	3	5	1-3
	10-24	20-35	1.40-1.60	0.6-2.0	0.12-0.16	7.4-8.4	Low-----------	0.28			
	24-60	20-35	1.50-1.75	0.6-2.0	0.05-0.07	7.4-8.4	Low-----------	0.28			
EdE, EdF---------- Eden	0-3	27-60	1.45-1.65	0.06-0.6	0.11-0.17	5.1-8.4	Moderate------	0.17	3	8	.5-3
	3-40	40-60	1.45-1.65	0.06-0.2	0.08-0.13	5.1-8.4	Moderate------	0.28			
	40	---	---	---	---	---	--------------	0.17			
EkB, EkC2--------- Elkinsville	0-9	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	.5-2
	9-24	22-30	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.0	Moderate------	0.37			
	24-58	16-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate------	0.37			
	58-70	20-34	1.40-1.60	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
ErF*:											
Eden-------------	0-6	27-50	1.35-1.55	0.06-0.6	0.12-0.18	5.1-8.4	Moderate------	0.43	3	7	.5-3
	6-34	40-60	1.45-1.65	0.06-0.2	0.08-0.13	5.1-8.4	Moderate------	0.28			
	34	---	---	---	---	---	--------------	0.17			
Rock outcrop.											
GrD2-------------- Grayford	0-6	12-25	1.25-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	5-4	5	.5-2
	6-33	20-30	1.35-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate------	0.37			
	33-53	20-35	1.40-1.60	0.6-2.0	0.16-0.20	4.5-5.5	Moderate------	0.37			
	53-80	42-50	1.40-1.60	0.6-2.0	0.09-0.11	5.1-6.0	High----------	0.37			
GrE--------------- Grayford	0-9	12-25	1.25-1.40	0.6-2.0	0.20-0.24	4.0-7.3	Low-----------	0.37	5-4	5	.5-2
	9-30	20-35	1.40-1.60	0.6-2.0	0.16-0.20	4.5-5.5	Moderate------	0.37			
	30-80	42-50	1.40-1.60	0.6-2.0	0.09-0.11	5.1-6.0	High----------	0.37			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cm3	In/hr	In/in	pH					Pct
Hd---------------- Haymond	0-6	10-18	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	6-55	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
	55-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.37			
HkD2, HkD3, HkE-- Hickory	0-13	19-25	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37	5	6	1-2
	13-47	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate------	0.37			
	47-60	15-32	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low-----------	0.37			
Hn---------------- Holton	0-7	5-18	1.20-1.45	0.6-2.0	0.15-0.20	5.6-7.3	Low-----------	0.37	5	5	1-3
	7-41	5-18	1.25-1.45	0.6-2.0	0.13-0.17	5.6-7.3	Low-----------	0.24			
	41-60	5-20	1.25-1.45	0.6-2.0	0.12-0.16	5.6-7.3	Low-----------	0.24			
Lb---------------- Lobdell	0-8	15-27	1.20-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	5	5	1-3
	8-52	18-30	1.25-1.60	0.6-2.0	0.17-0.22	5.1-7.3	Low-----------	0.37			
	52-60	15-30	1.20-1.60	0.6-6.0	0.12-0.18	5.6-7.3	Low-----------	0.37			
No---------------- Nolin	0-7	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43	5	5	2-4
	7-55	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43			
	55-80	10-30	1.30-1.55	0.6-6.0	0.10-0.23	5.1-8.4	Low-----------	0.43			
PeB2-------------- Pekin	0-8	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	4	5	1-3
	8-23	25-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43			
	23-54	22-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43			
	54-80	20-45	1.40-1.60	0.6-2.0	0.06-0.08	4.5-7.3	Low-----------	0.43			
Pt*. Pits											
RoA, RoB2--------- Rossmoyne	0-9	13-27	1.35-1.50	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.37	4	6	1-3
	9-28	22-35	1.40-1.60	0.6-2.0	0.14-0.19	4.5-5.5	Moderate------	0.37			
	28-80	24-35	1.70-1.90	0.06-0.6	0.06-0.10	4.5-5.5	Moderate------	0.37			
RyC2-------------- Ryker	0-22	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	5	1-4
	22-53	20-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Moderate------	0.37			
	53-80	20-40	1.45-1.65	0.6-2.0	0.15-0.20	4.5-6.0	Moderate------	0.37			
St---------------- Stonelick	0-9	10-22	1.20-1.45	0.6-2.0	0.15-0.20	7.4-8.4	Low-----------	0.24	5	5	1-3
	9-60	5-18	1.20-1.55	2.0-6.0	0.05-0.11	7.4-8.4	Low-----------	0.24			
SwC2, SwD2-------- Switzerland	0-7	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	4	5	.5-3
	7-28	25-35	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate------	0.43			
	28-64	55-70	1.35-1.60	<0.06	0.09-0.13	4.5-8.4	High----------	0.32			
	64	---	---	---	---	---	--------------	----			
Wa---------------- Wakeland	0-43	10-17	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	43-60	10-17	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
Wr---------------- Wirt	0-9	6-15	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.32	5	5	.5-3
	9-40	8-18	1.40-1.55	0.6-2.0	0.15-0.20	5.6-7.3	Low-----------	0.24			
	40-49	5-10	1.45-1.65	2.0-6.0	0.08-0.11	5.6-7.3	Low-----------	0.17			
	49-60	40-55	1.20-1.40	<0.06	0.09-0.11	7.4-8.4	High----------	0.32			
Wt---------------- Wirt	0-9	10-18	1.30-1.45	0.6-2.0	0.17-0.20	6.1-7.3	Low-----------	0.37	5	5	.5-3
	9-49	10-18	1.40-1.55	0.6-2.0	0.15-0.20	6.1-7.3	Low-----------	0.24			
	49-60	8-18	1.45-1.60	2.0-6.0	0.14-0.17	6.6-7.3	Low-----------	0.24			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ag----------------- Algiers	C	Frequent----	Very brief	Dec-Jun	1.0-2.0	Apparent	Jan-Jun	>60	---	High-----	High-----	Low.
AvA, AvB2---------- Avonburg	D	None--------	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High-----	High-----	High.
BaA---------------- Bartle	D	None--------	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High-----	High-----	High.
BeC2, BeD3, BeE--- Bonnell	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
CbD2, CbE---------- Carmel	C	None--------	---	---	>6.0	---	---	>40	Soft	Moderate	High-----	Moderate.
CcB2, CcC2, CcC3, CcD2-------------- Cincinnati	C	None--------	---	---	>4.0	Perched	Jan-Apr	>60	---	High-----	Moderate	High.
Cm----------------- Cobbsfork	D	None--------	---	---	+.5-1.0	Perched	Dec-Apr	>60	---	High-----	High-----	High.
Dr----------------- Dearborn	B	Frequent----	Very brief	Nov-Mar	>6.0	---	---	>60	---	Moderate	Low------	Low.
EdE, EdF----------- Eden	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low.
EkB, EkC2---------- Elkinsville	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
ErF*: Eden---------------	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low.
Rock outcrop.												
GrD2, GrE---------- Grayford	B	None--------	---	---	>6.0	---	---	>60	---	High-----	High-----	Moderate.
Hd----------------- Haymond	B	Frequent----	Brief-----	Jan-May	>6.0	---	---	>60	---	High-----	Low------	Low.
HkD2, HkD3, HkE--- Hickory	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Hn----------------- Holton	C	Frequent----	Brief-----	Nov-Jun	1.0-3.0	Apparent	Nov-Jun	>60	---	High-----	Moderate	High.
Lb----------------- Lobdell	B	Frequent----	Brief-----	Jan-Apr	2.0-3.5	Apparent	Dec-Apr	>60	---	High-----	Low------	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
No----------------- Nolin	B	Frequent----	Brief to long.	Feb-May	3.0-6.0	Apparent	Feb-Mar	>60	---	---	Low-------	Moderate.
PeB2-------------- Pekin	C	None---------	---	---	2.0-6.0	Apparent	Mar-Apr	>60	---	High-----	Moderate	High.
Pt*. Pits												
RoA, RoB2--------- Rossmoyne	C	None---------	---	---	1.5-3.0	Perched	Jan-Apr	>60	---	High-----	High-----	High.
RyC2-------------- Ryker	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
St----------------- Stonelick	B	Frequent----	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low-------	Low.
SwC2, SwD2-------- Switzerland	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
Wa----------------- Wakeland	C	Frequent----	Brief-----	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.
Wr----------------- Wirt	B	Frequent----	Very brief	Dec-May	>6.0	---	---	>60	---	Moderate	Low-------	Moderate.
Wt----------------- Wirt	B	Frequent----	Brief-----	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low-------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

[MAX means maximum dry density; OPT, optimum moisture; LL, liquid limit; PI, plasticity index; and UN, Unified]

Soil name and location	Parent material	Report number	Depth	Moisture density		Percentage passing sieve--				Percentage smaller than--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	UN
			In	Lb/ft^3	Pct									Pct			
Cobbsfork silt loam: southeast corner of sec. 27, T. 8 N., R. 12 E.	Loess.	S79-IN-137															
		7-2	8-18	107	15	100	100	96	83	75	57	18	8	25	15	A-6	CL
		7-3	18-31	107	16	100	100	95	84	75	53	16	7	30	1	A-4	ML
		7-5	39-52	106	18	100	99	94	83	80	51	22	13	35	21	A-6	CL
		7-6	52-92	112	15	100	99	96	82	69	57	25	15	28	18	A-6	CL
Rossmoyne silt loam: southeast corner of sec. 12, T. 9 N., R. 13 E.	36 inches of loess over silty glacial drift.	S78-IN-137															
		7-3	14-23	102	19	100	100	99	96	92	68	29	21	42	24	A-7-6	CL
		7-5	28-36	109	18	100	100	99	92	82	60	22	14	37	13	A-6	CL
		7-6	36-51	107	15	100	100	98	86	81	63	30	21	37	30	A-6	CL

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Algiers	Fine-loamy, mixed, nonacid, mesic Aquic Udifluvents
*Avonburg	Fine-silty, mixed, mesic Aeric Fragiaqualfs
*Bartle	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Bonnell	Fine, mixed, mesic Typic Hapludalfs
*Carmel	Fine, vermiculitic, mesic Typic Hapludalfs
Cincinnati	Fine-silty, mixed, mesic Typic Fragiudalfs
*Cobbsfork	Fine-silty, mixed, mesic Typic Ochraqualfs
*Dearborn	Loamy-skeletal, mixed, mesic Fluventic Hapludolls
Eden	Fine, mixed, mesic Typic Hapludalfs
Elkinsville	Fine-silty, mixed, mesic Ultic Hapludalfs
*Grayford	Fine-loamy, mixed, mesic Typic Hapludalfs
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Hickory	Fine-loamy, mixed, mesic Typic Hapludalfs
Holton	Coarse-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Lobdell	Fine-loamy, mixed, mesic Fluvaquentic Eutrochrepts
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
*Pekin	Fine-silty, mixed, mesic Aquic Fragiudalfs
*Rossmoyne	Fine-silty, mixed, mesic Aquic Fragiudalfs
Ryker	Fine-silty, mixed, mesic Typic Paleudalfs
Stonelick	Coarse-loamy, mixed (calcareous), mesic Typic Udifluvents
*Switzerland	Fine-silty over clayey, mixed, mesic Typic Hapludalfs
Wakeland	Coarse-silty, mixed, nonacid, mesic Aeric Fluvaquents
Wirt	Coarse-loamy, mixed, nonacid, mesic Typic Udifluvents

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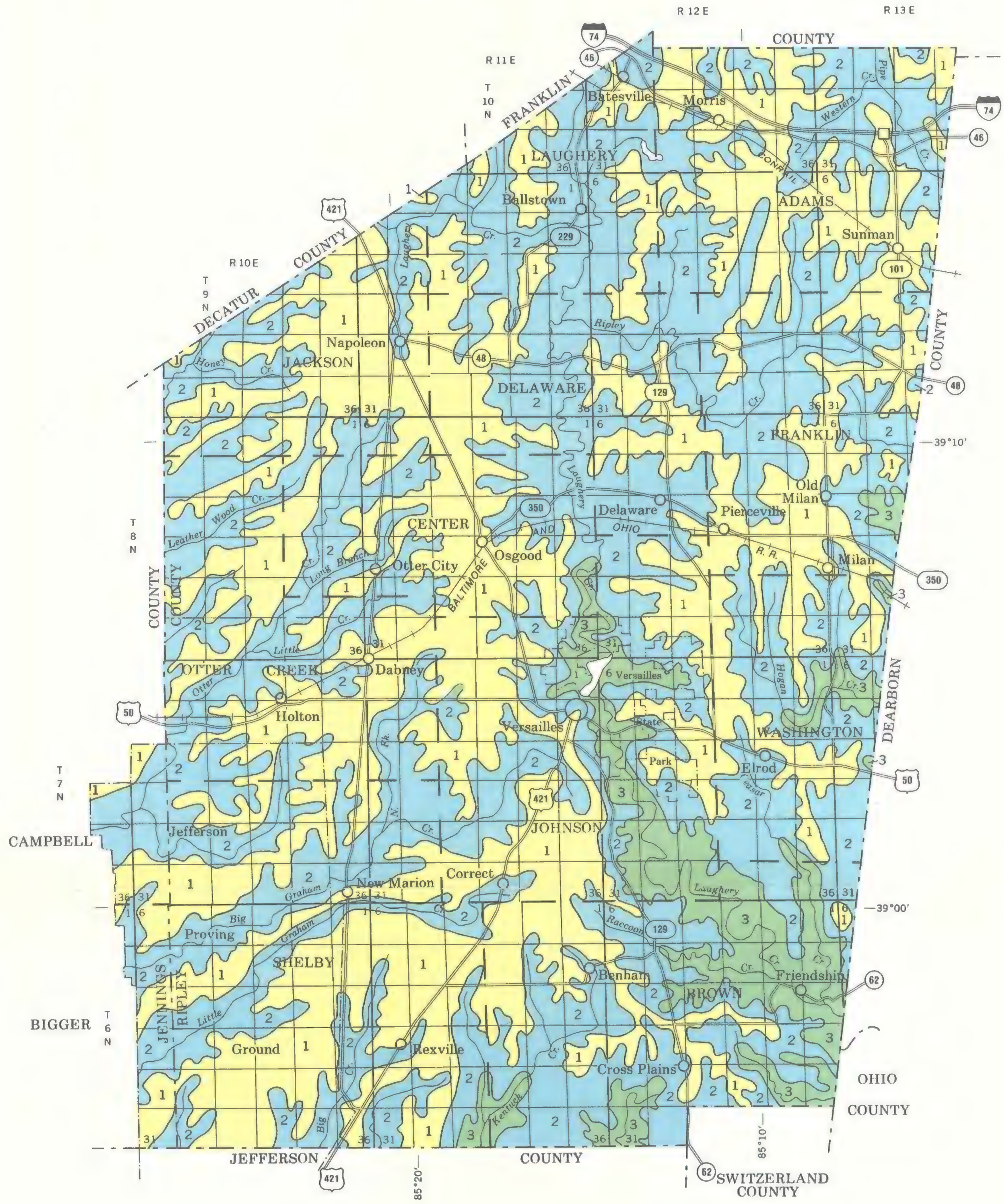


SOIL LEGEND*

1	COBBSFORK-AVONBURG: Deep, nearly level and gently sloping, poorly drained and somewhat poorly drained, medium textured soils formed in loess and silty glacial drift; on upland ridgetops
2	CINCINNATI-ROSSMOYNE-HICKORY: Deep, nearly level to steep, well drained and moderately well drained, medium textured soils formed in loess and in the underlying silty glacial drift or glacial till; on upland side slopes and ridgetops
3	EDEN-CARMEL-SWITZERLAND: Moderately deep and deep, moderately sloping to very steep, well drained, medium textured and moderately fine textured soils formed in shale and limestone residuum or in loess and the underlying residuum; on upland side slopes

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the map units.

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Compiled 1983

N

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES,
SOIL AND WATER CONSERVATION COMMITTEE

GENERAL SOIL MAP

RIPLEY COUNTY AND PART OF JENNINGS COUNTY INDIANA

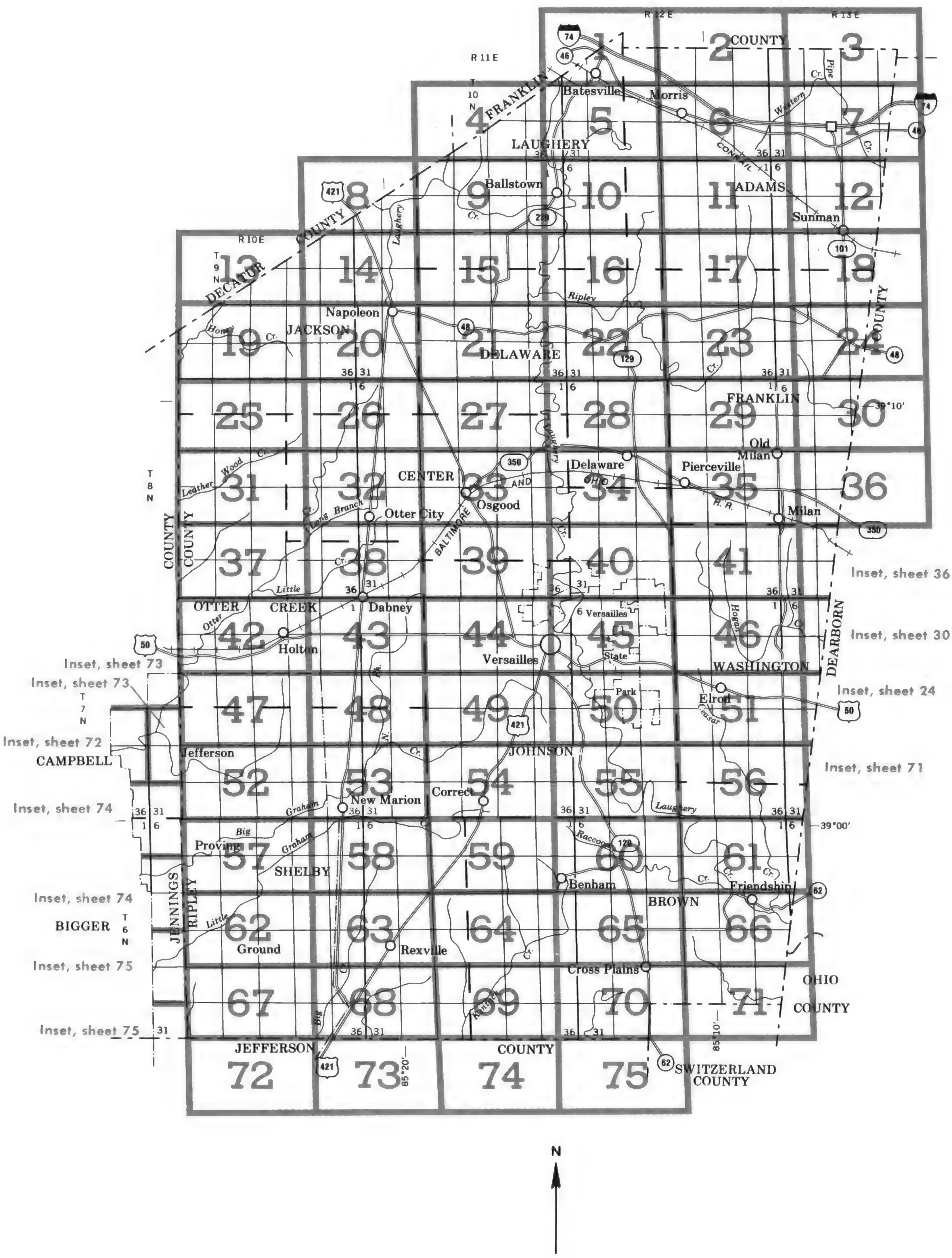
Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



INDEX TO MAP SHEETS

RIPLEY COUNTY AND PART OF JENNINGS COUNTY
INDIANA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

SYMBOL	NAME
Ag	Algiers silt loam, frequently flooded
AvA	Avonburg silt loam, 0 to 2 percent slopes
AvB2	Avonburg silt loam, 2 to 6 percent slopes, eroded
BaA	Bartle silt loam, 0 to 2 percent slopes
BeC2	Bonnell silt loam, 6 to 12 percent slopes, eroded
BeD3	Bonnell silt loam, 12 to 18 percent slopes, severely eroded
BeE	Bonnell silt loam, 18 to 35 percent slopes
CbD2	Carmel silt loam, 12 to 18 percent slopes, eroded
CbE	Carmel silt loam, 18 to 35 percent slopes
CcB2	Cincinnati silt loam, 2 to 6 percent slopes, eroded
CcC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded
CcC3	Cincinnati silt loam, 6 to 12 percent slopes, severely eroded
CcD2	Cincinnati silt loam, 12 to 18 percent slopes, eroded
Cm	Cobbsfork silt loam
Dr	Dearborn fine sandy loam, frequently flooded
EdE	Eden flaggy silty clay loam, 18 to 25 percent slopes
EdF	Eden flaggy silty clay loam, 25 to 50 percent slopes
EkB	Elkinsville silt loam, 2 to 6 percent slopes
EkC2	Elkinsville silt loam, 6 to 12 percent slopes, eroded
ErF	Eden-Rock outcrop complex, 25 to 50 percent slopes
GrD2	Grayford silty clay loam, 12 to 18 percent slopes, eroded
GrE	Grayford silt loam, 18 to 35 percent slopes
Hd	Haymond silt loam, frequently flooded
HkD2	Hickory silt loam, 12 to 18 percent slopes, eroded
HkD3	Hickory silt loam, 12 to 18 percent slopes, severely eroded
HkE	Hickory loam, 18 to 35 percent slopes
Hn	Holton silt loam, frequently flooded
Lb	Lobdell silt loam, frequently flooded
No	Nolin silt loam, frequently flooded
PeB2	Pekin silt loam, 2 to 6 percent slopes, eroded
Pt	Pits, Quarry
RoA	Rossmoyne silt loam, 0 to 2 percent slopes
RoB2	Rossmoyne silt loam, 2 to 6 percent slopes, eroded
RyC2	Ryker silt loam, 6 to 12 percent slopes,eroded
St	Stonelick loam, frequently flooded
SwC2	Switzerland silt loam, 6 to 12 percent slopes, eroded
SwD2	Switzerland silt loam, 12 to 18 percent slopes, eroded
Wa	Wakeland silt loam, frequently flooded
Wr	Wirt loam, flaggy clay substratum, frequently flooded
Wt	Wirt silt loam, frequently flooded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CnB, WaC2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

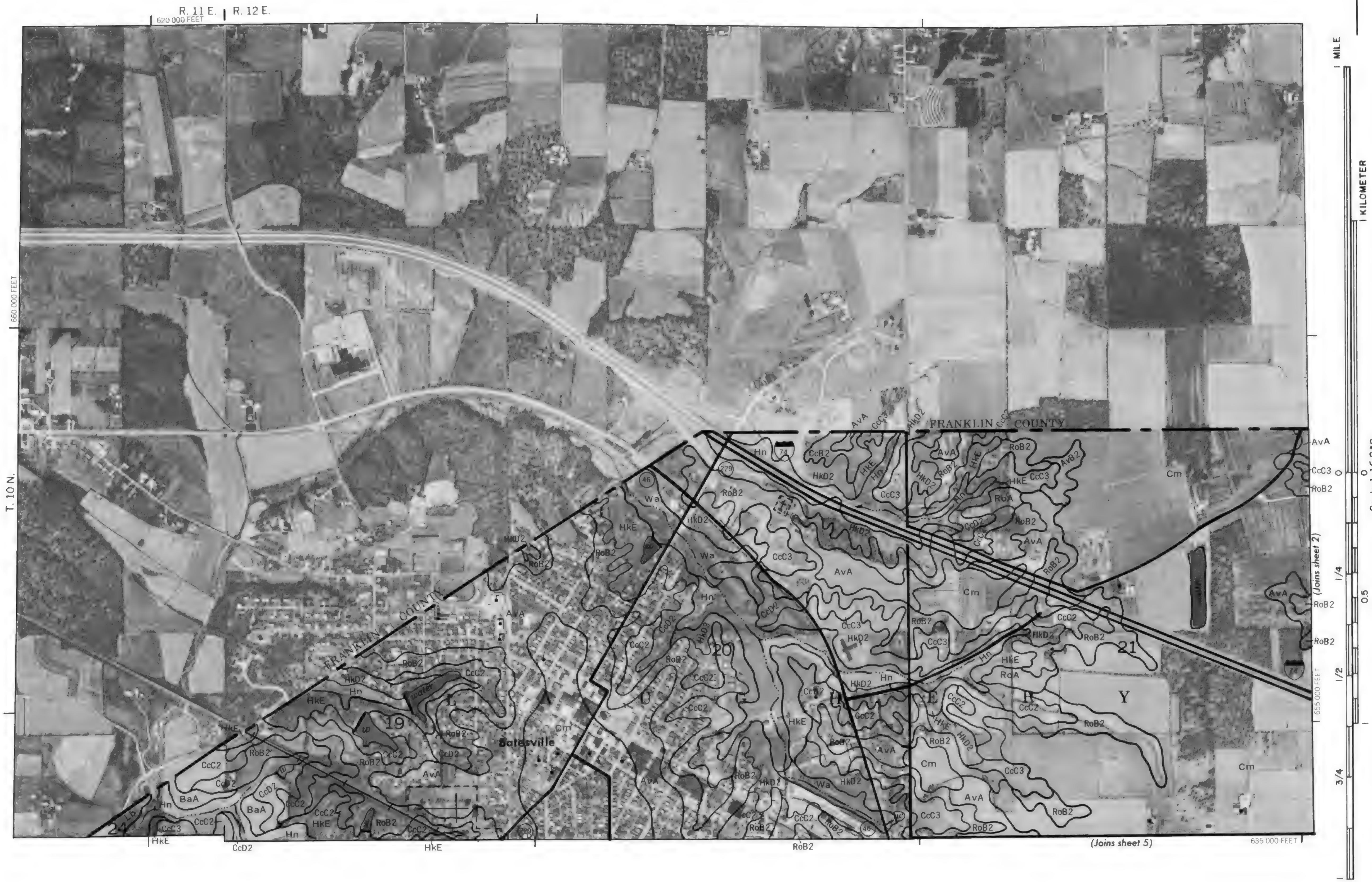
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Cut and fill land (up to 3 acres)

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 1

1

N



RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 1

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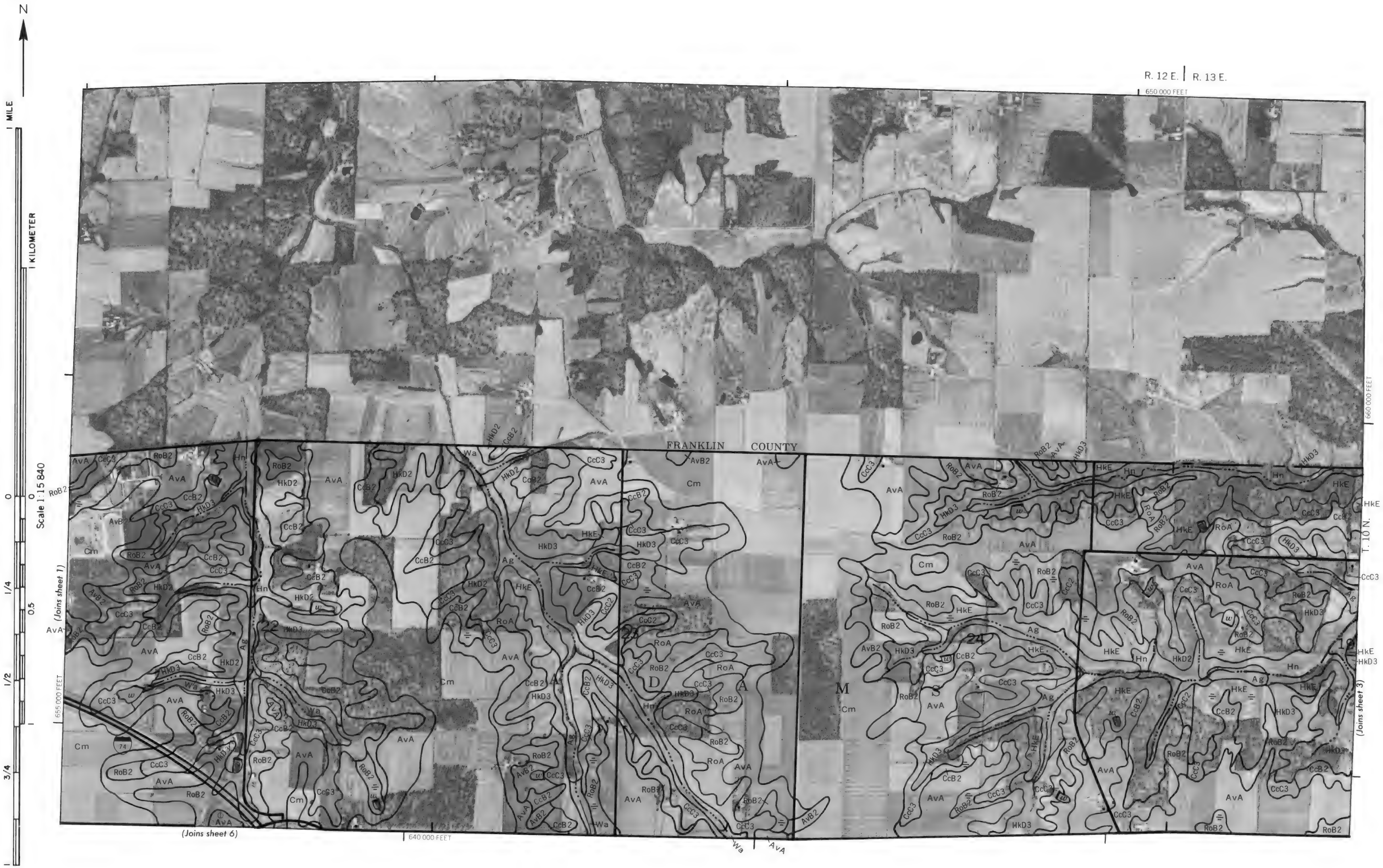
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 2



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SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 3

3

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 3

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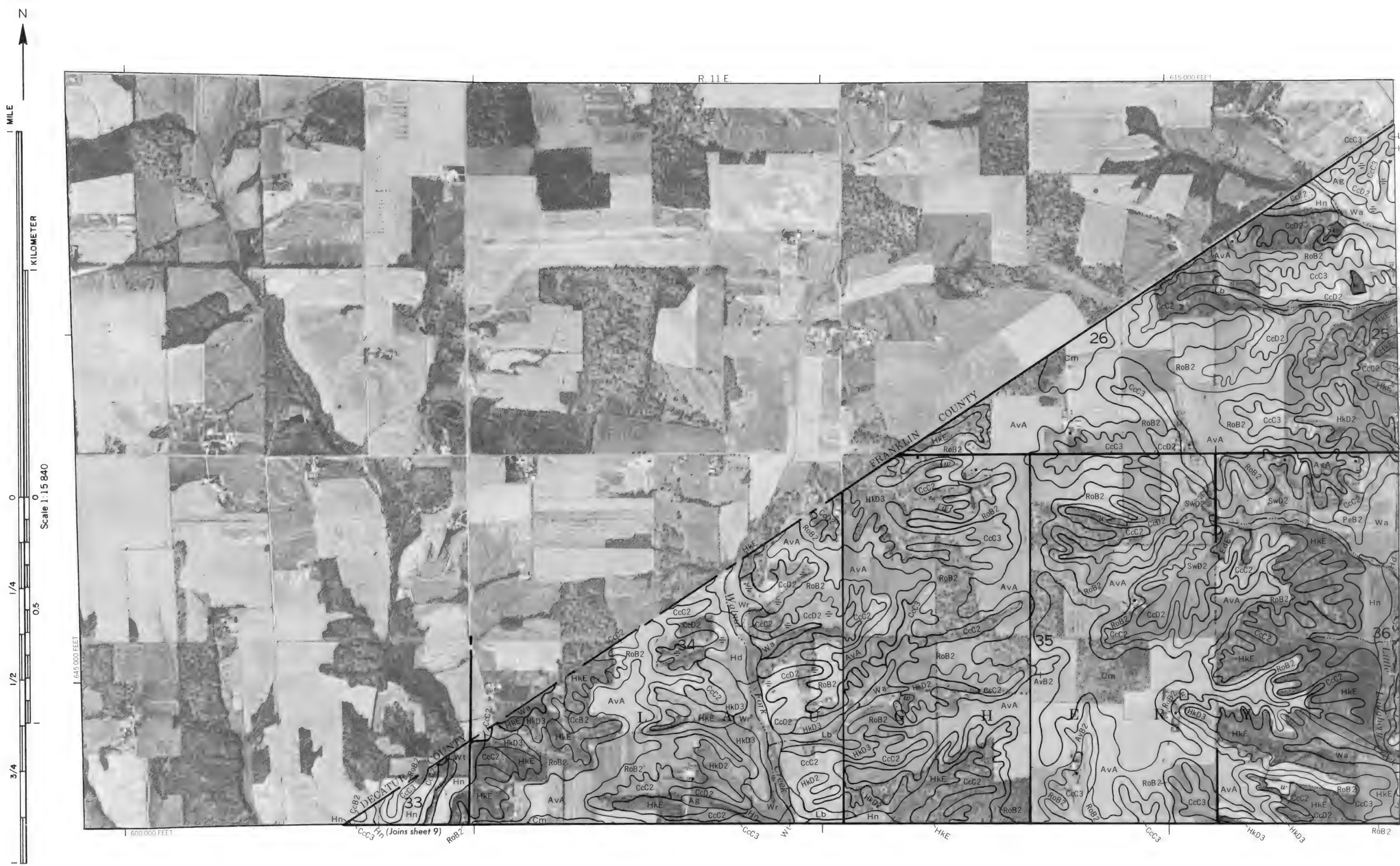
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 4



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RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 5

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SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 6

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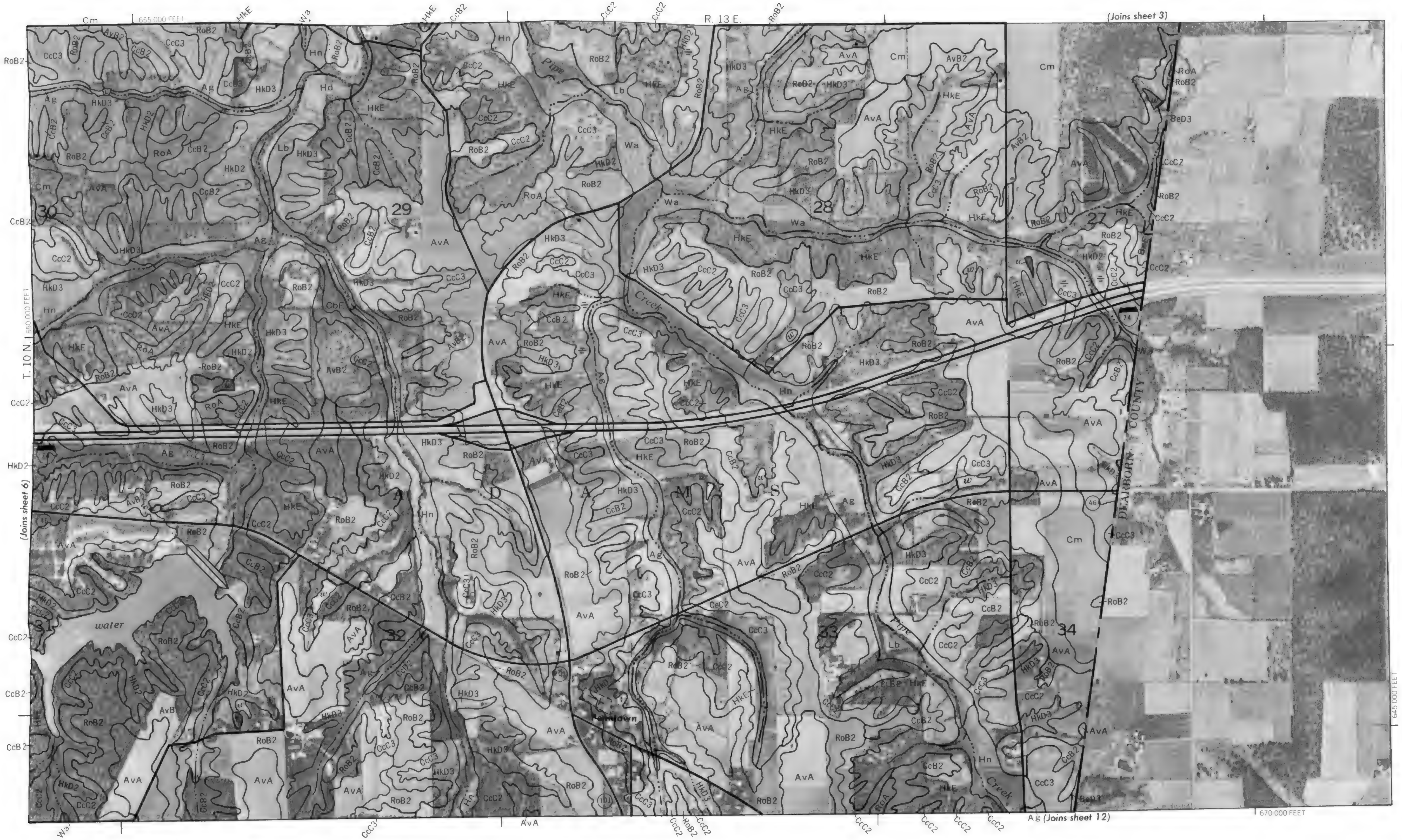
RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 6

7



N

1 MILE
1 KILOMETER
Scale 1:15 840

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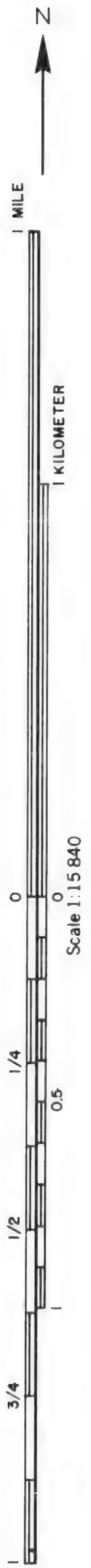
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 8



RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 8

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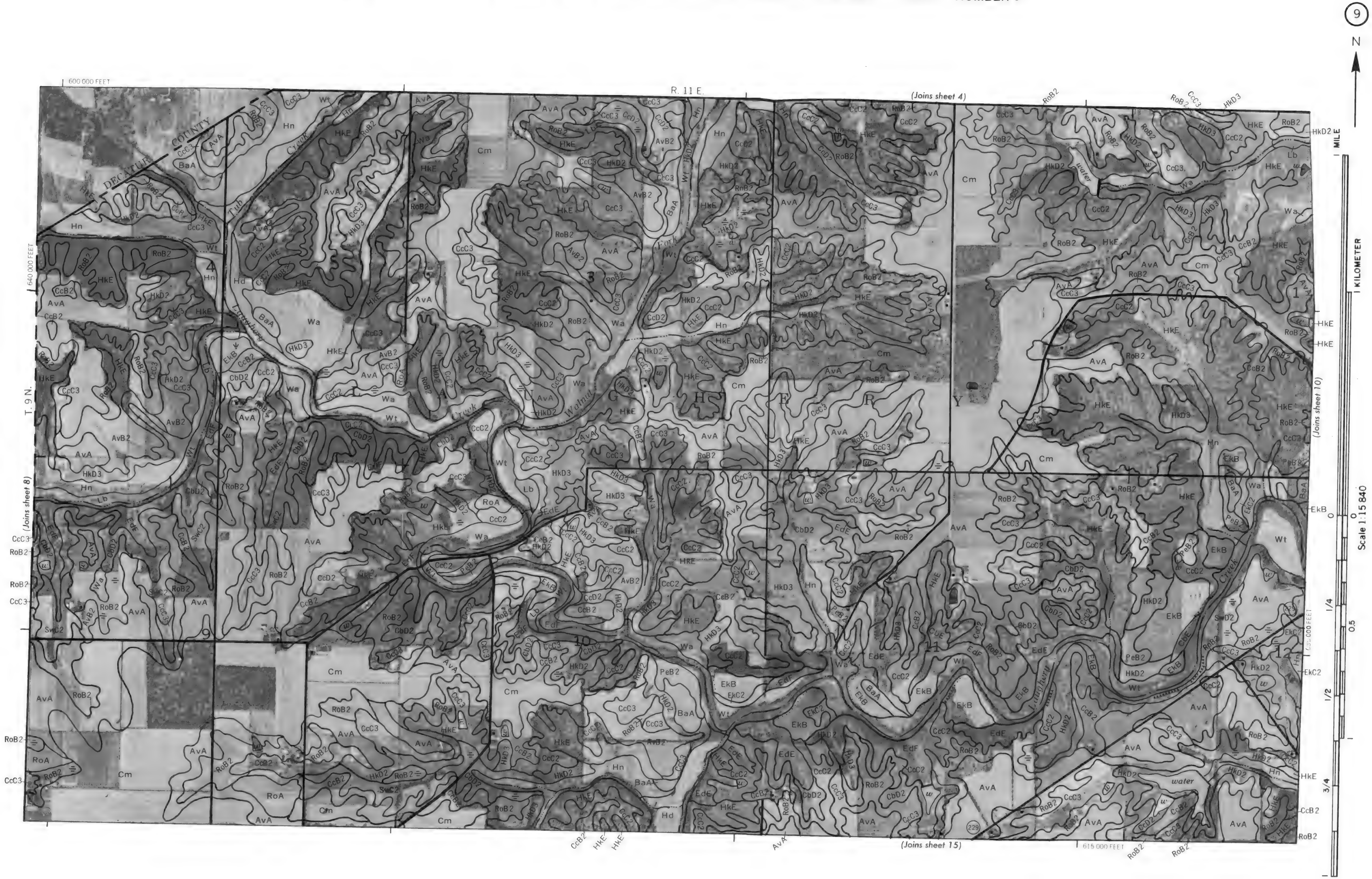
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 9



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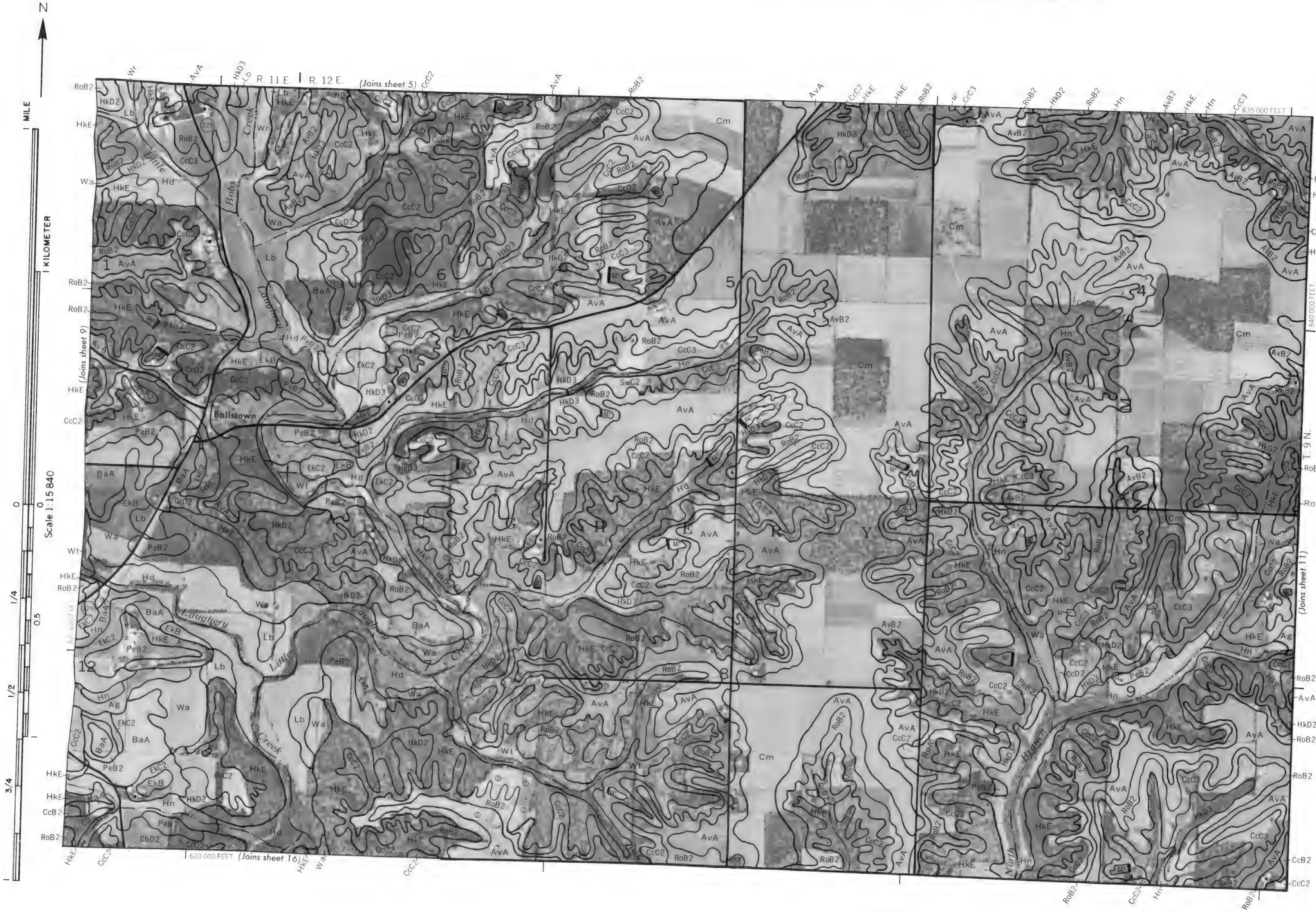
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 10



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SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 11

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 11

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SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 12

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RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 12

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 13

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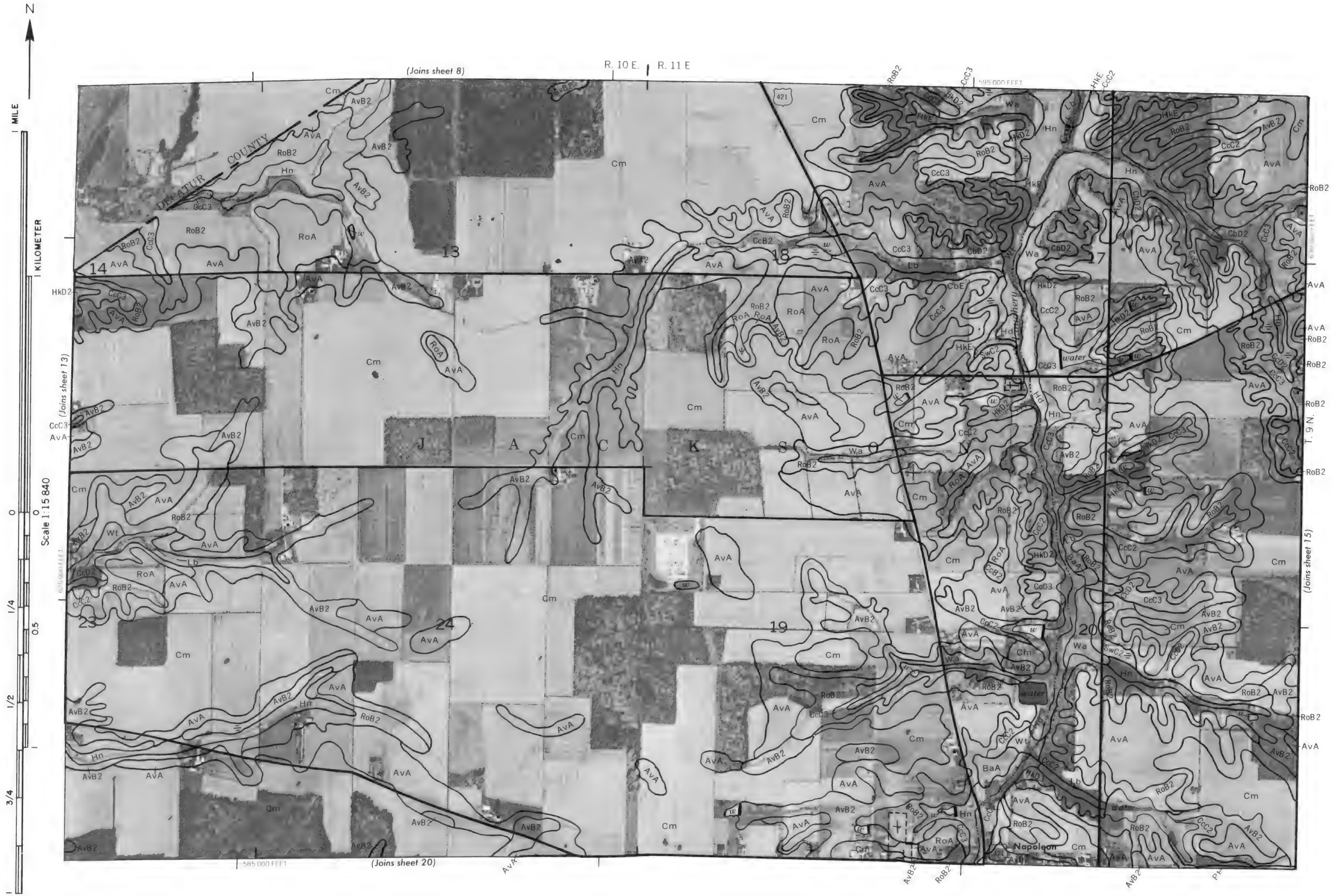
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 14



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Coordinate grid ticks and land division corners, if shown, are approximately positioned

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 15

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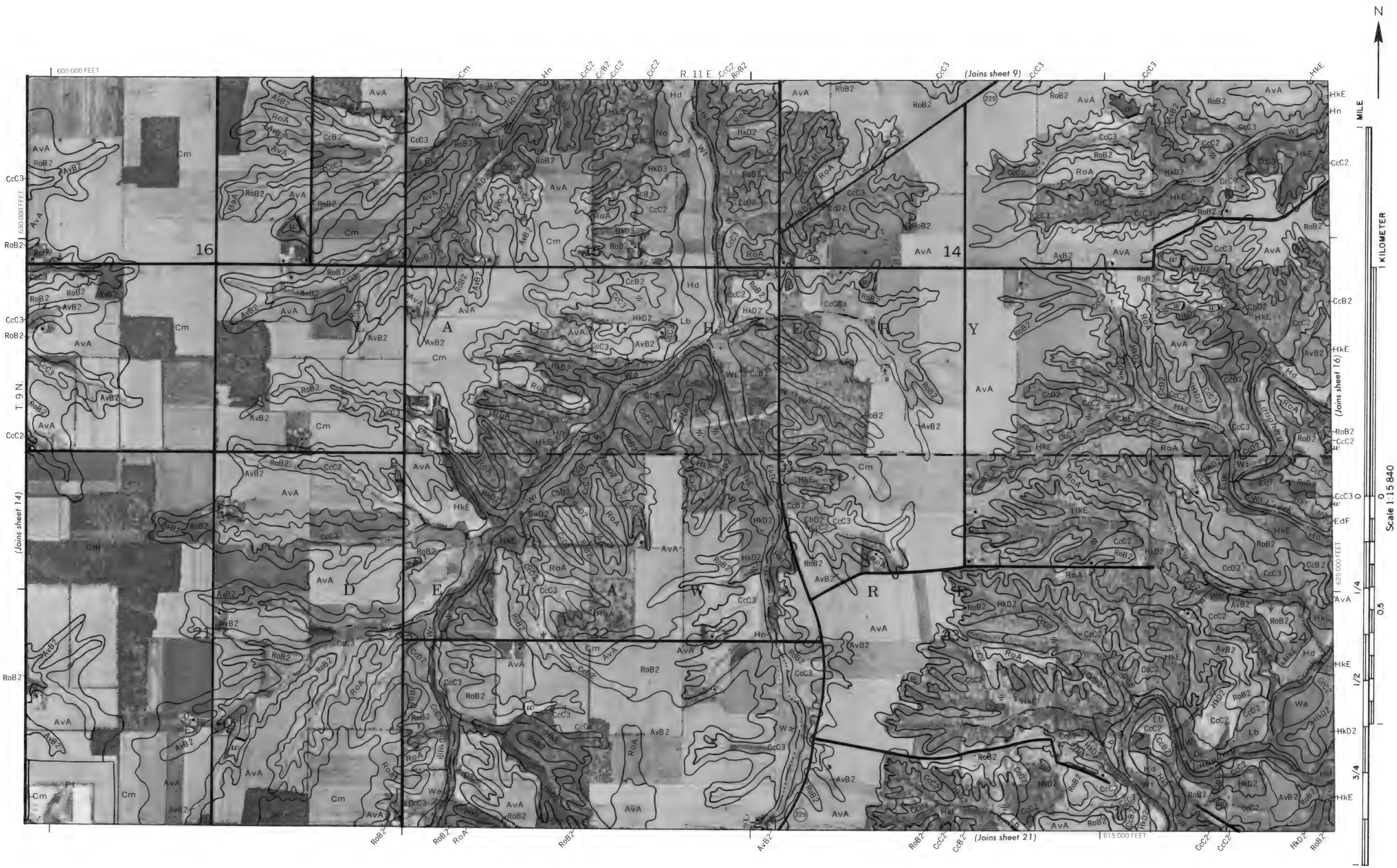
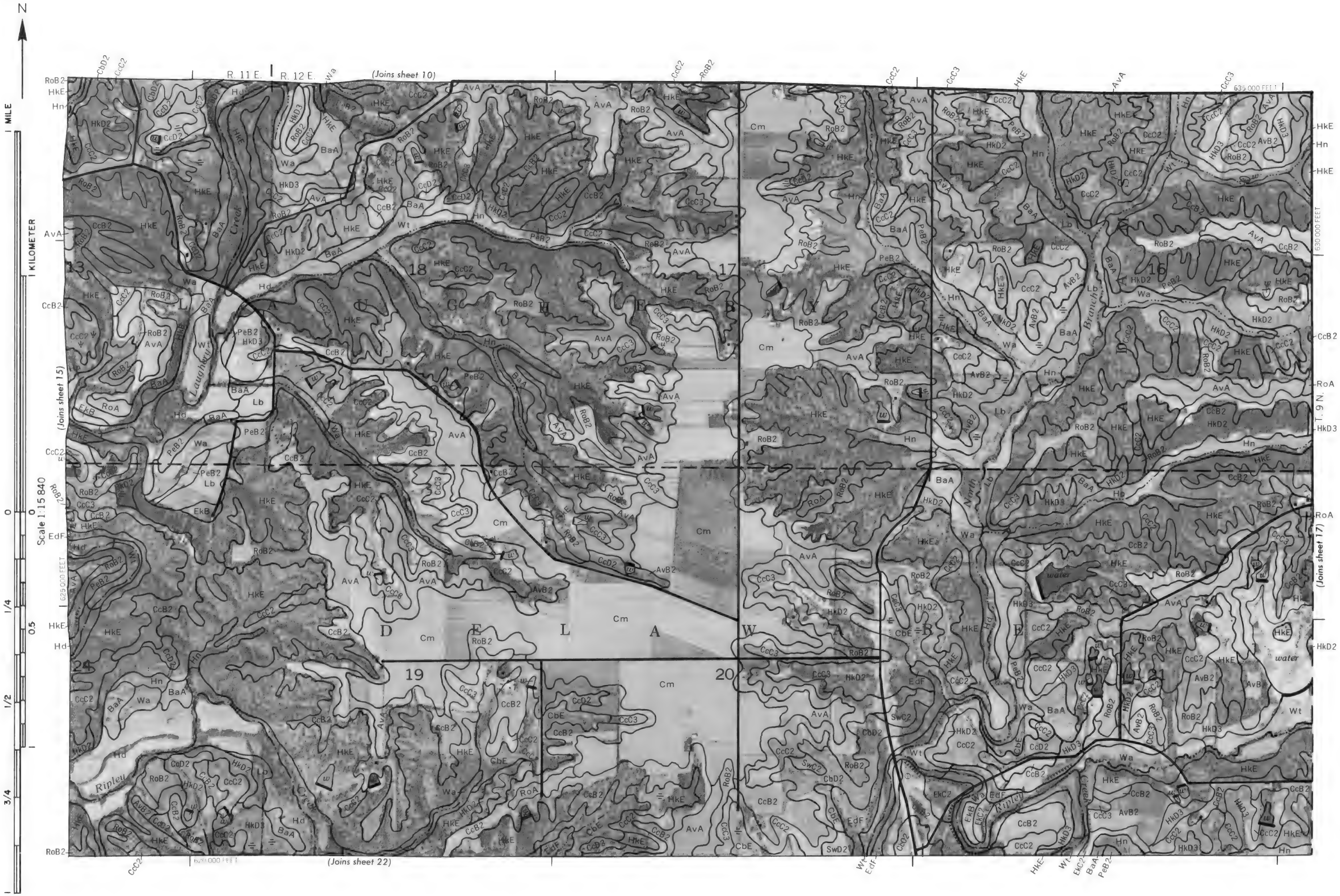


SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 16



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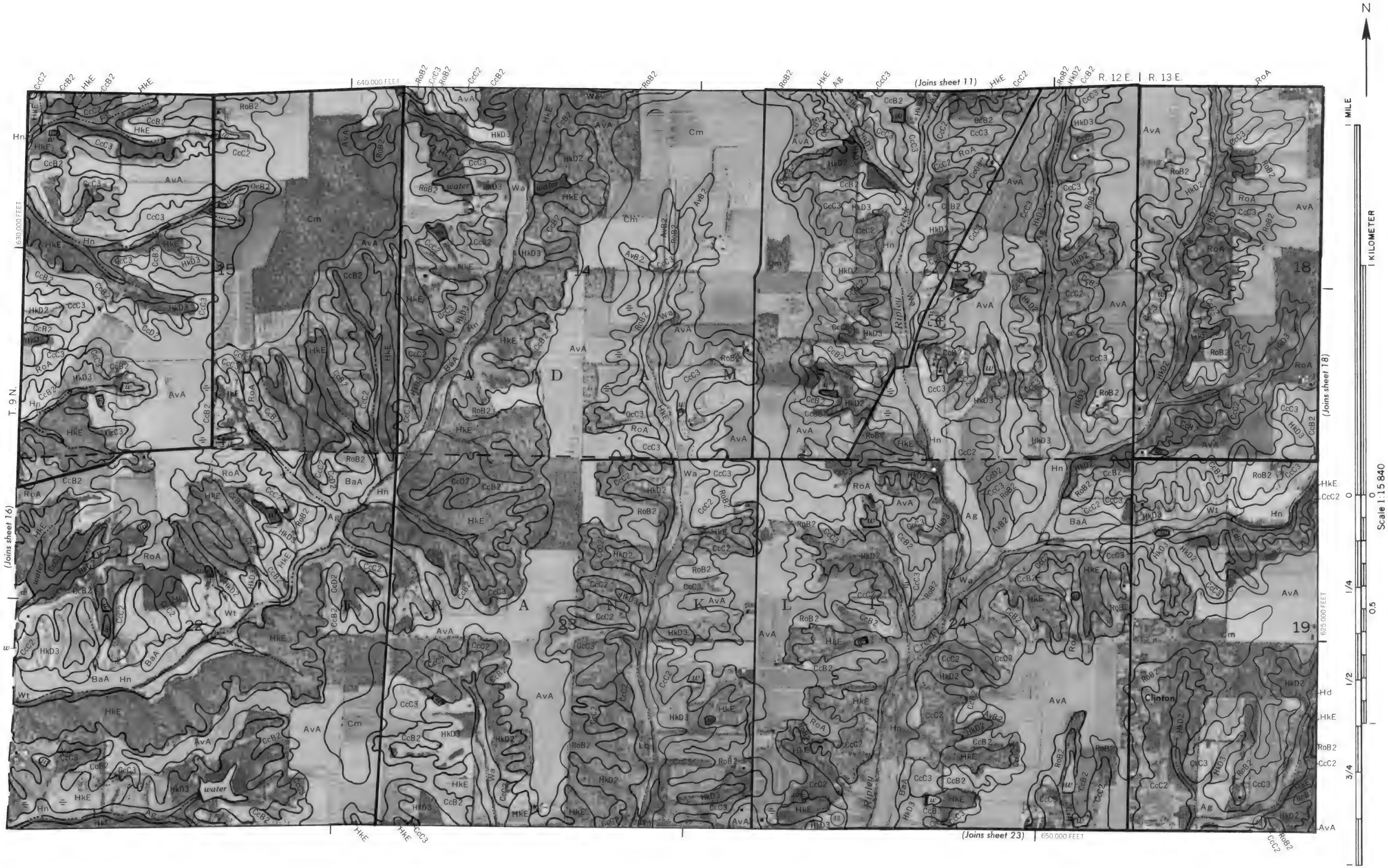

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 17

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SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 20

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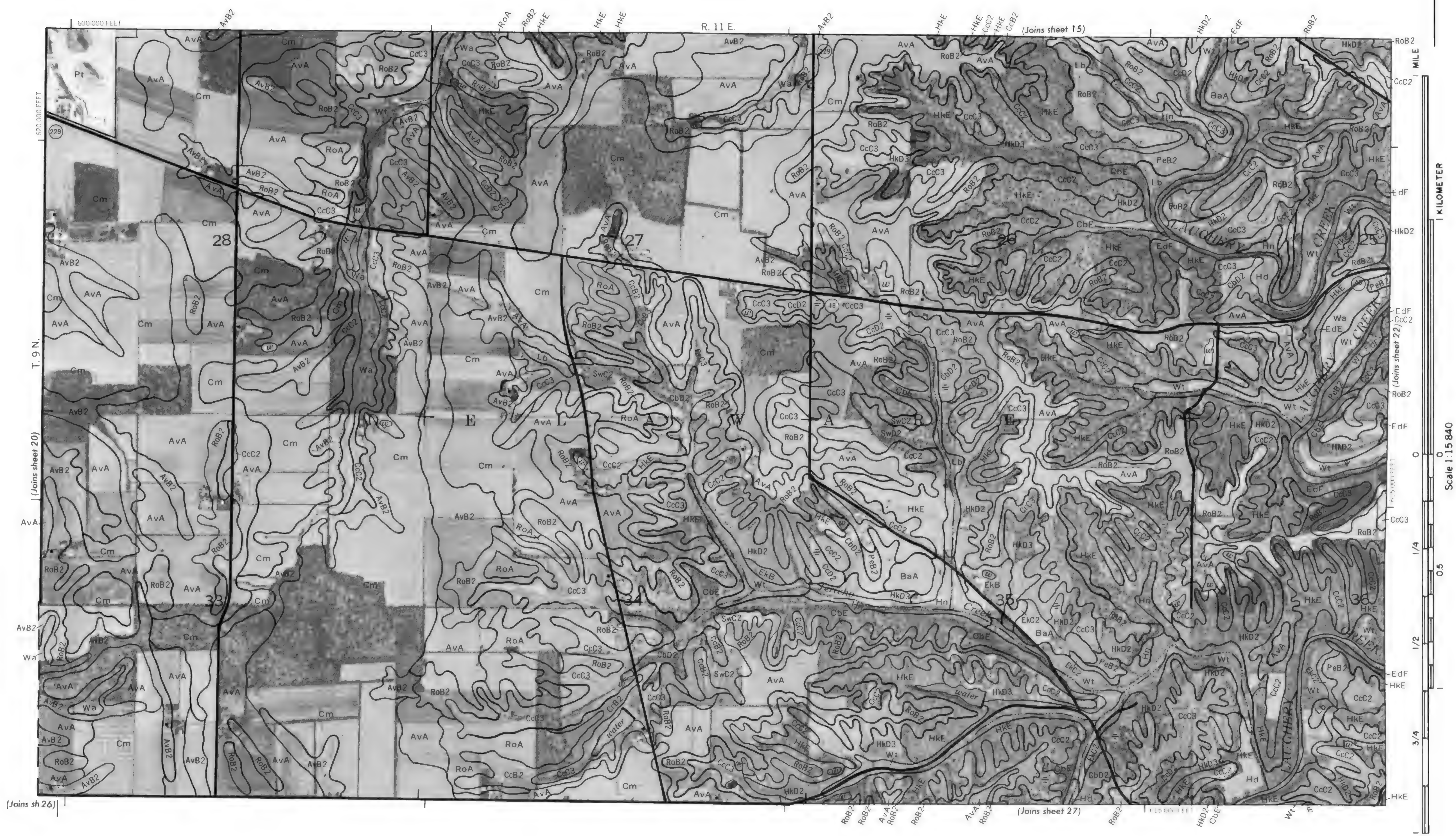
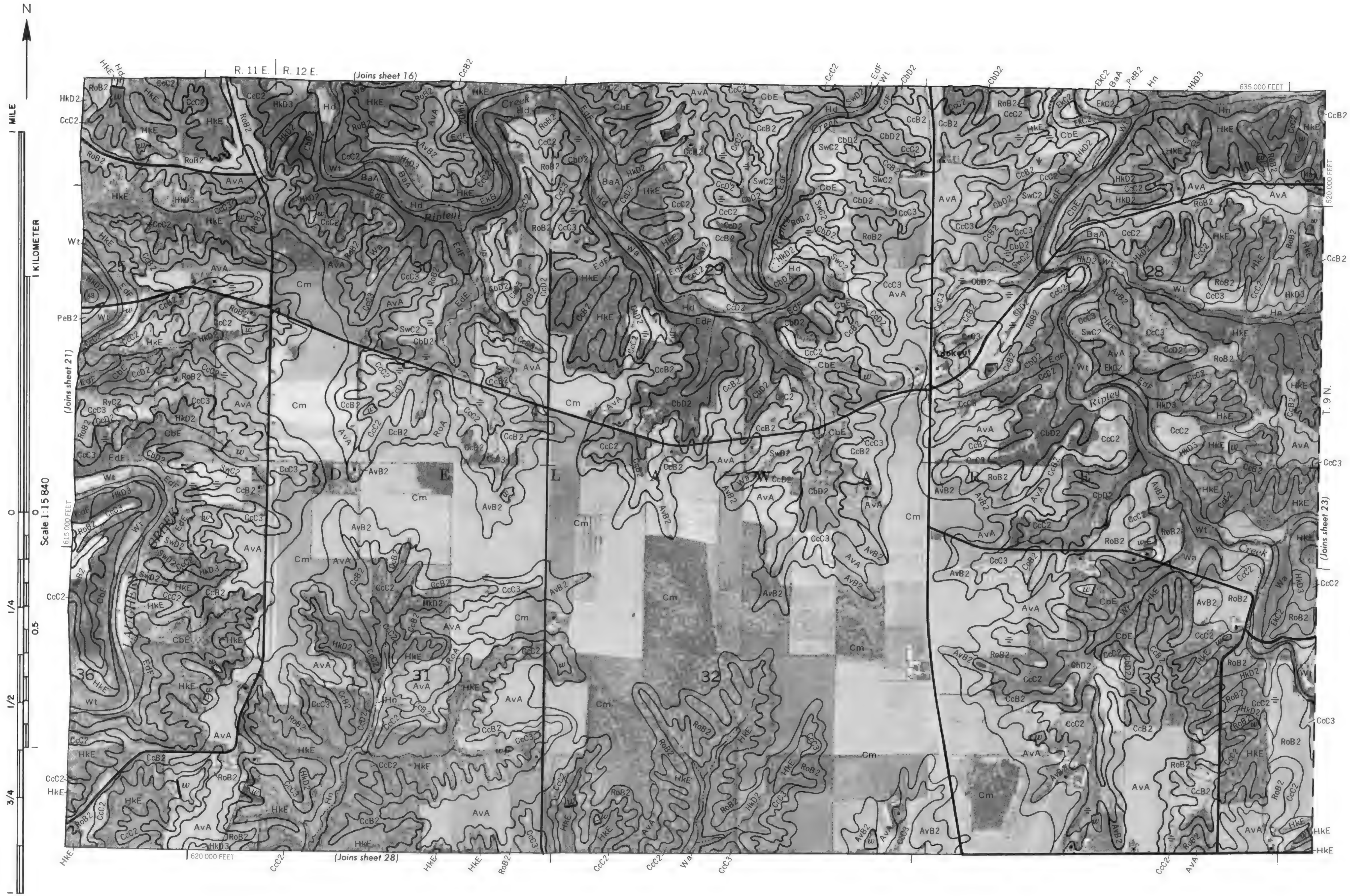
RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 20



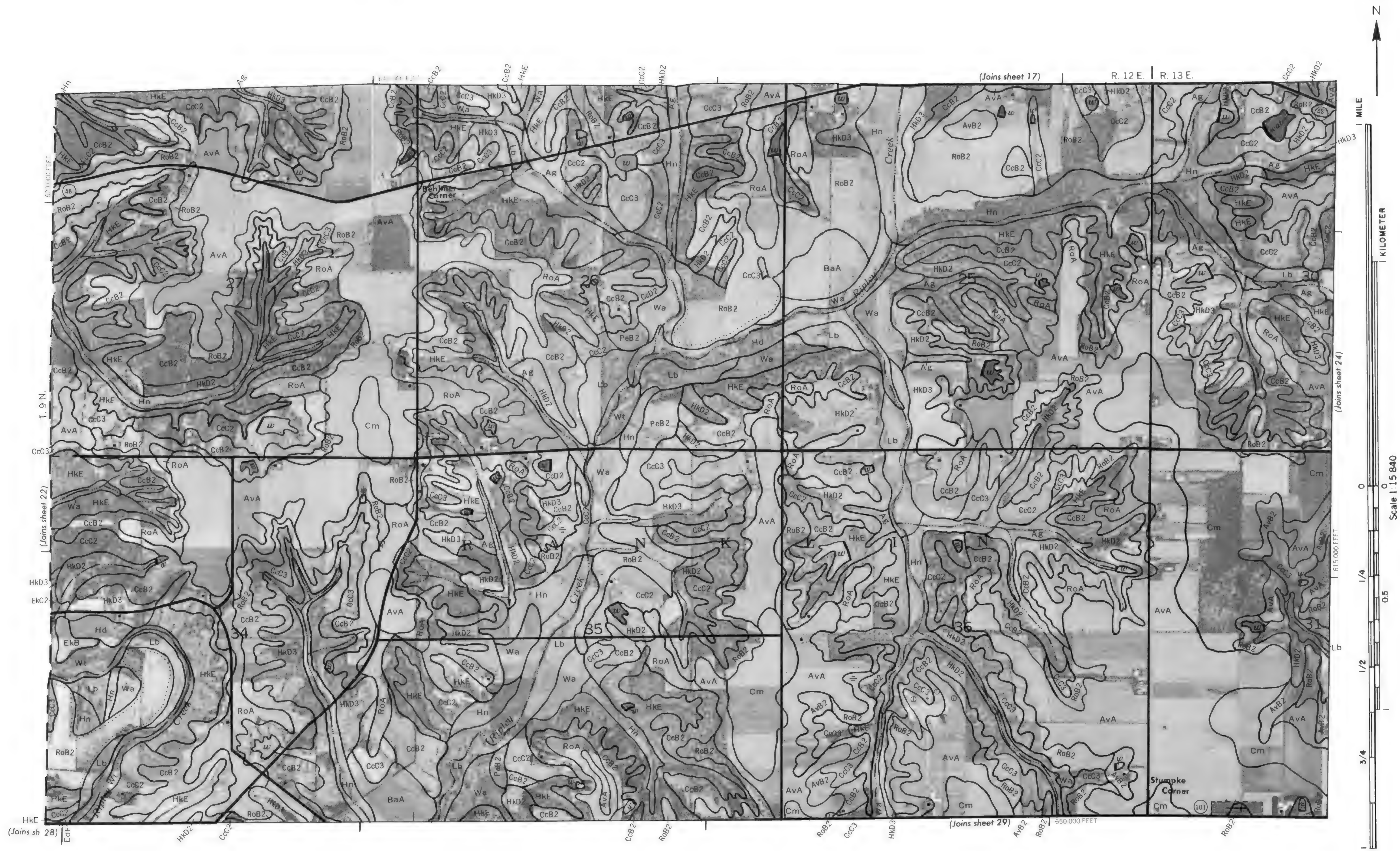
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 22



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

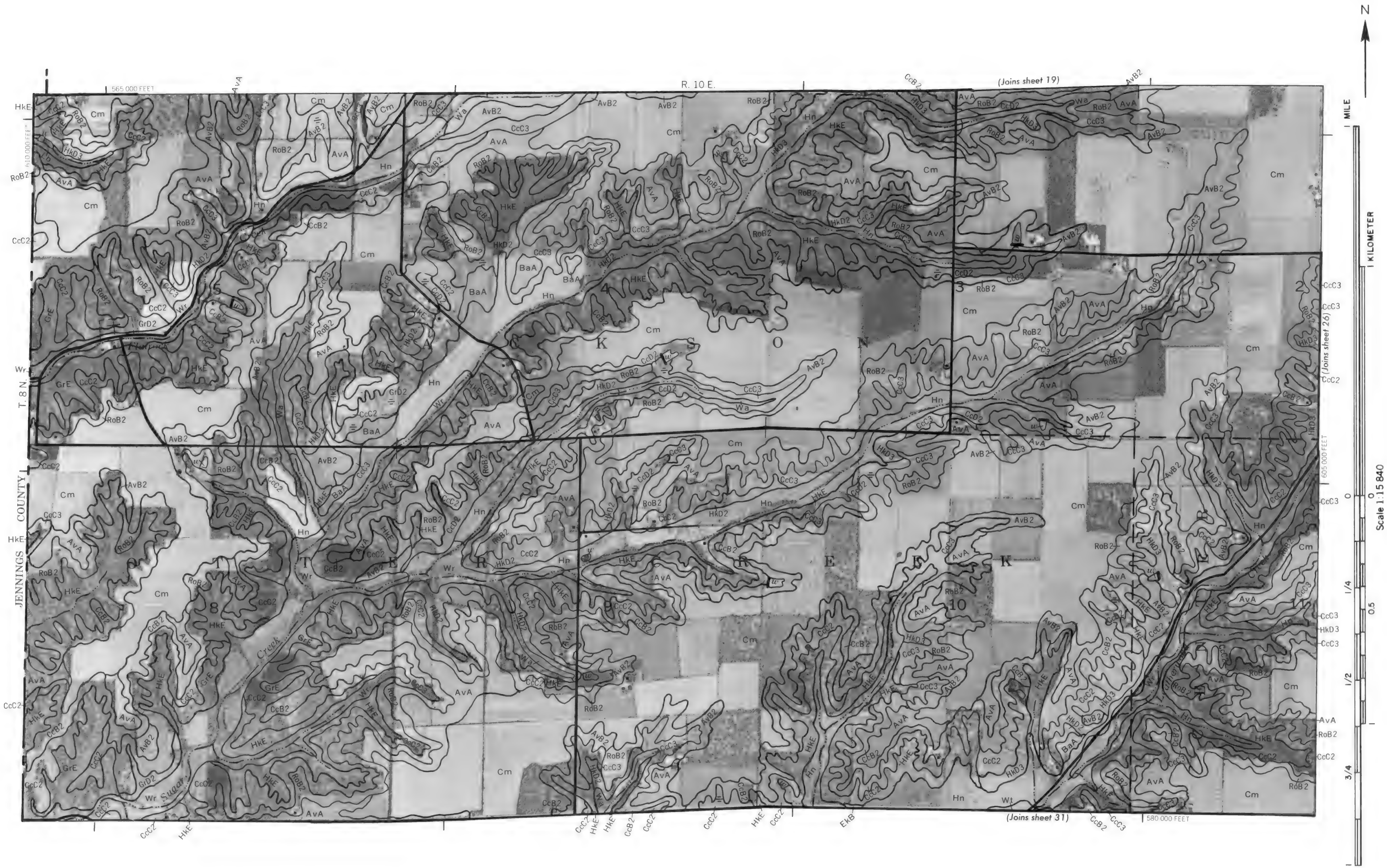
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 23



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

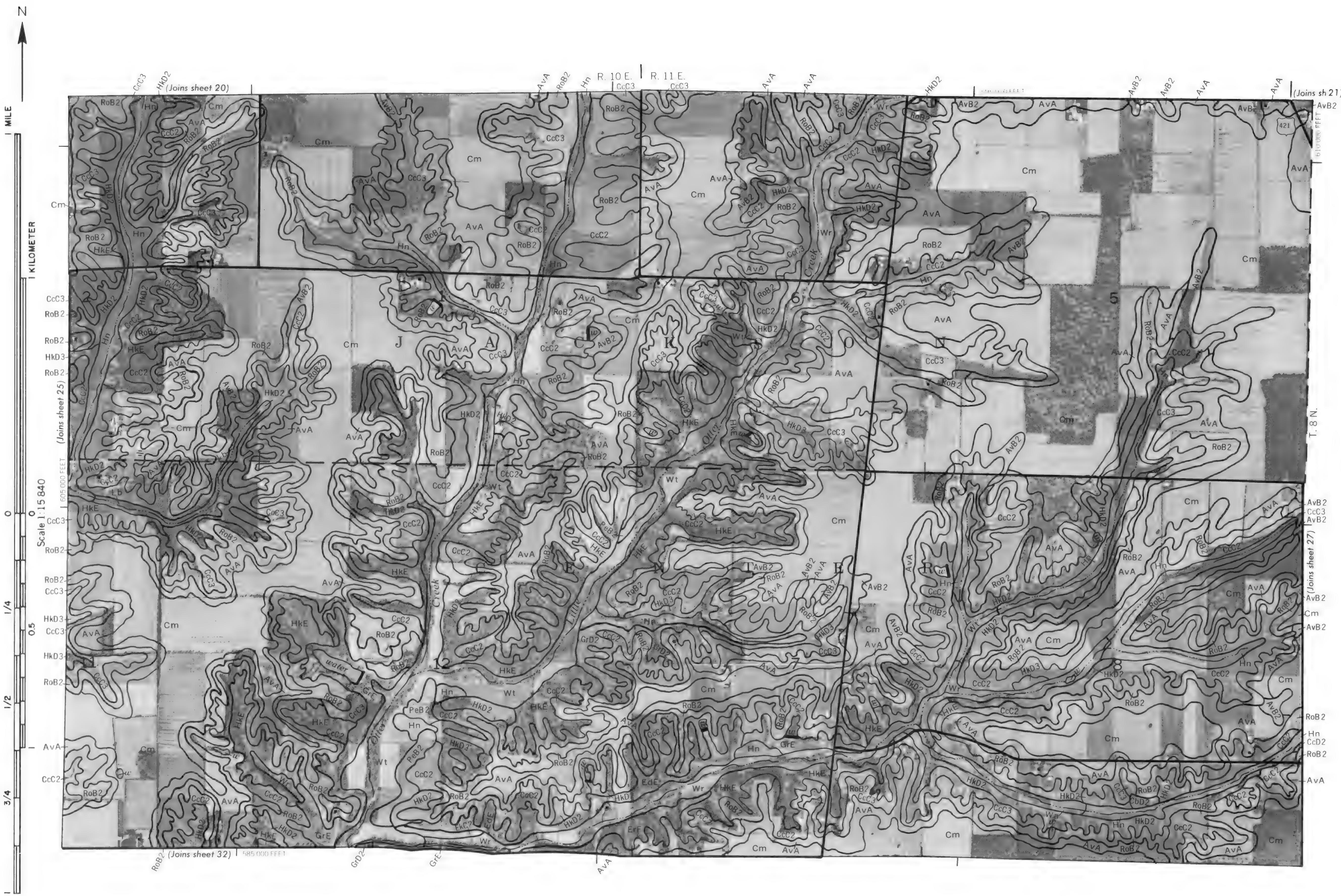
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 24

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 26



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

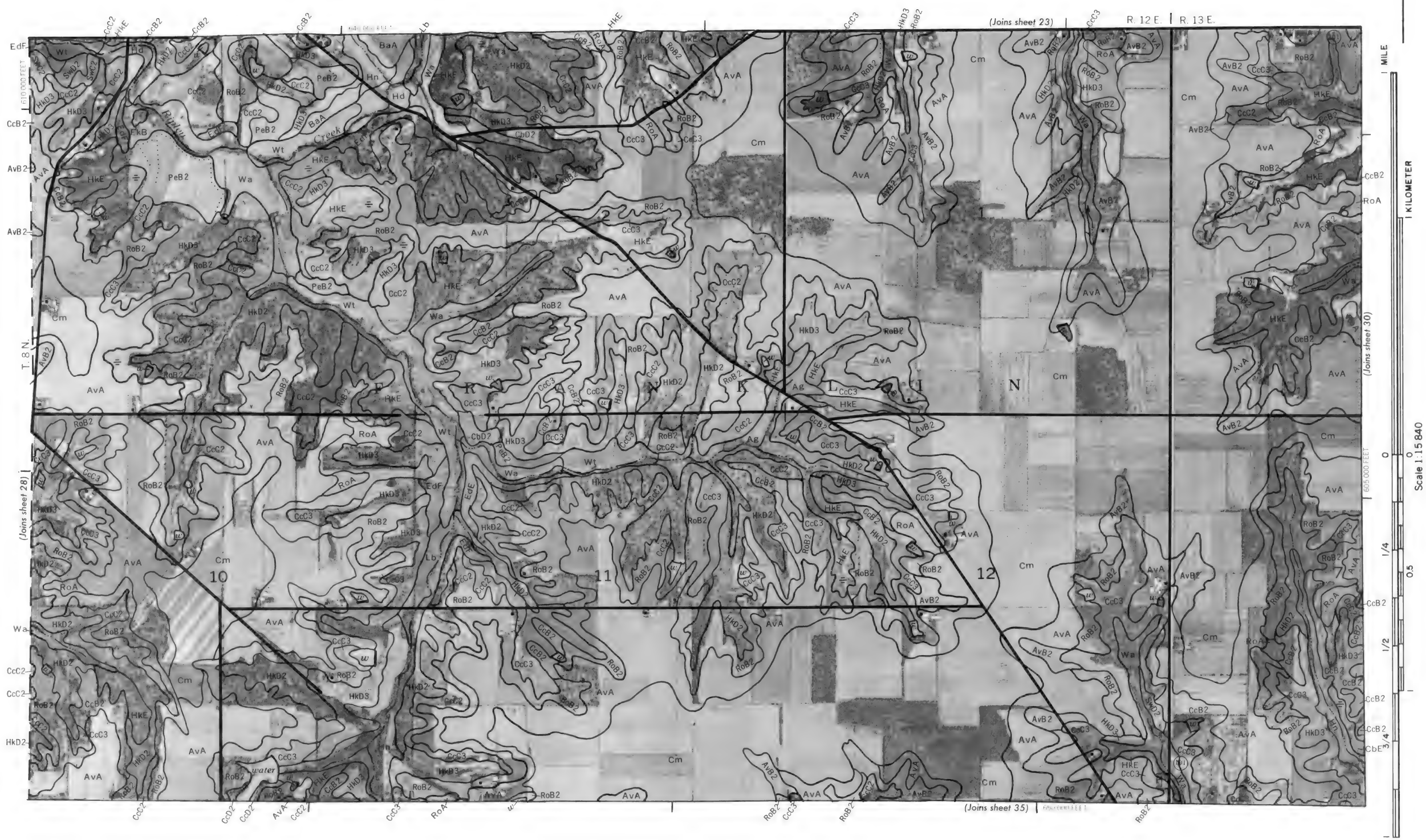
RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 27

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 28

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

29



RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 29

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(30)

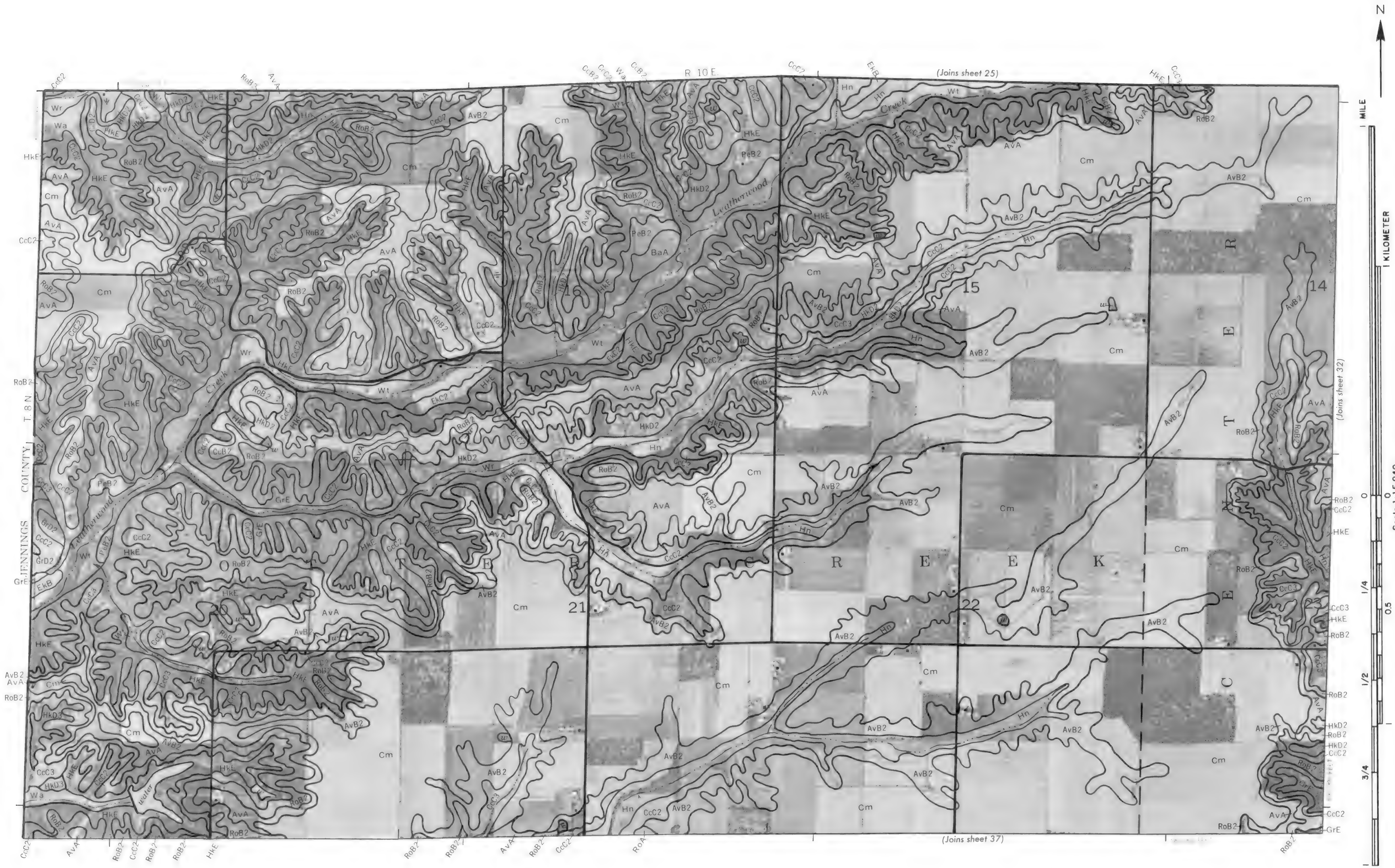
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 30

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 30

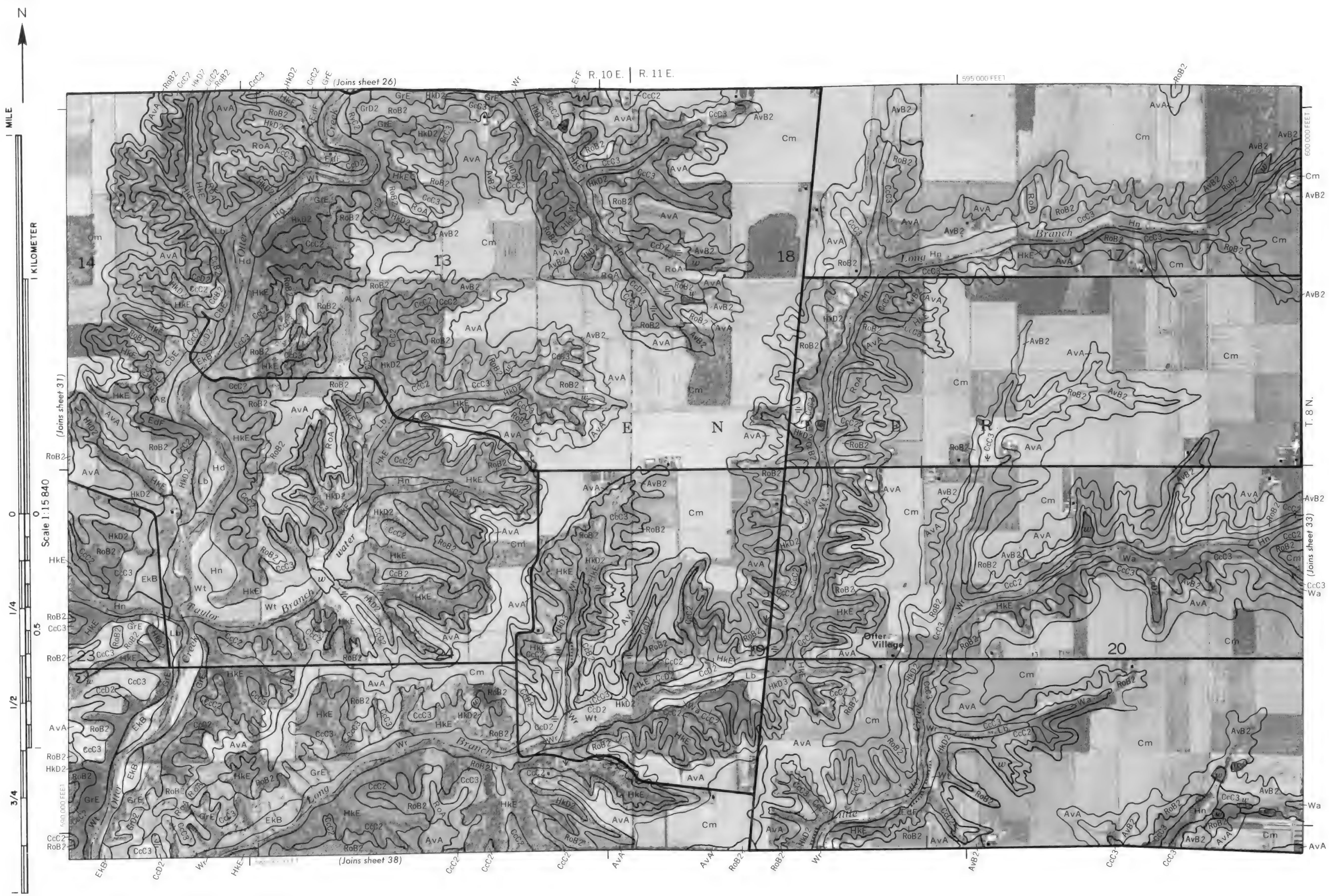
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 31

31



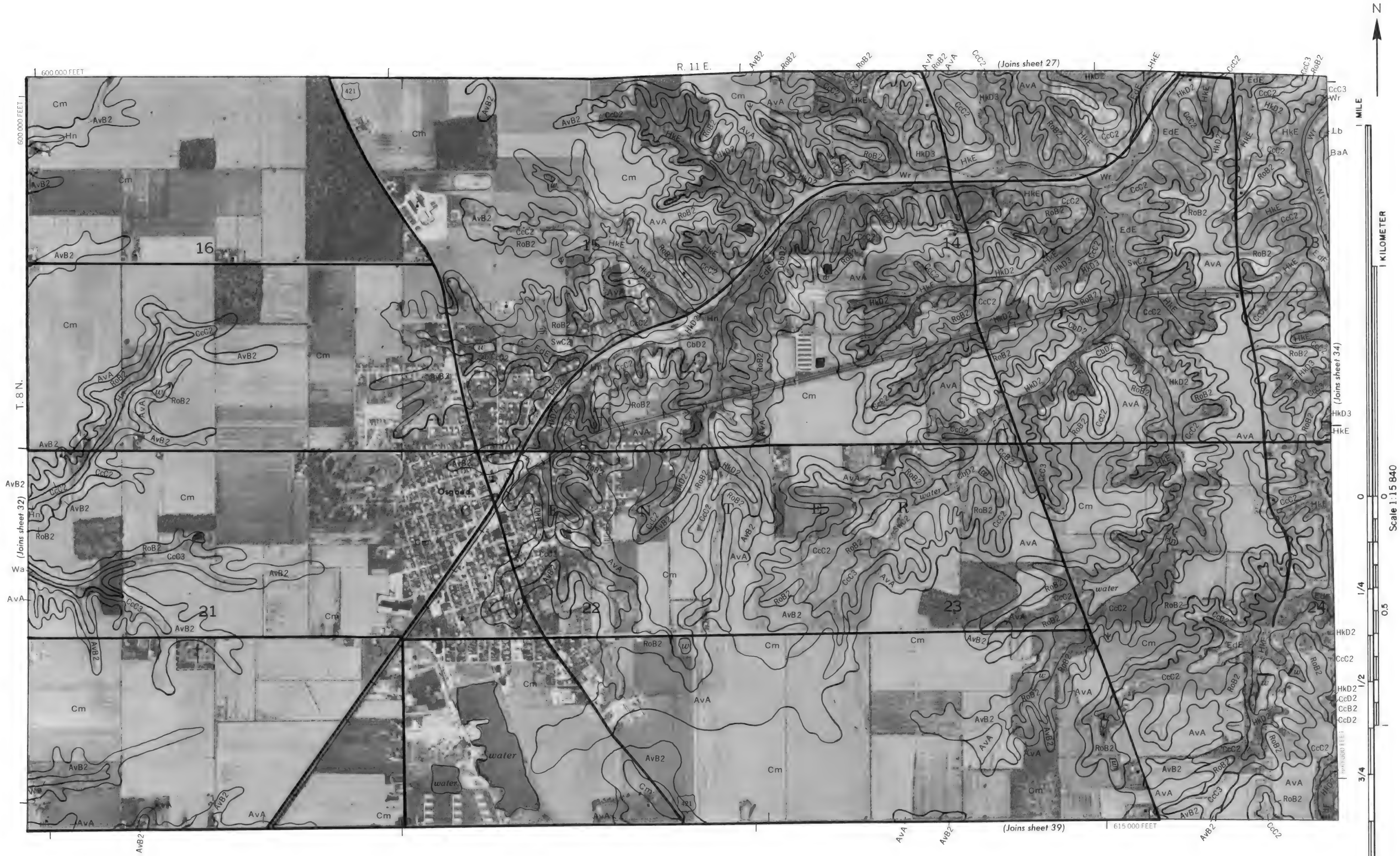
RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 31

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 33

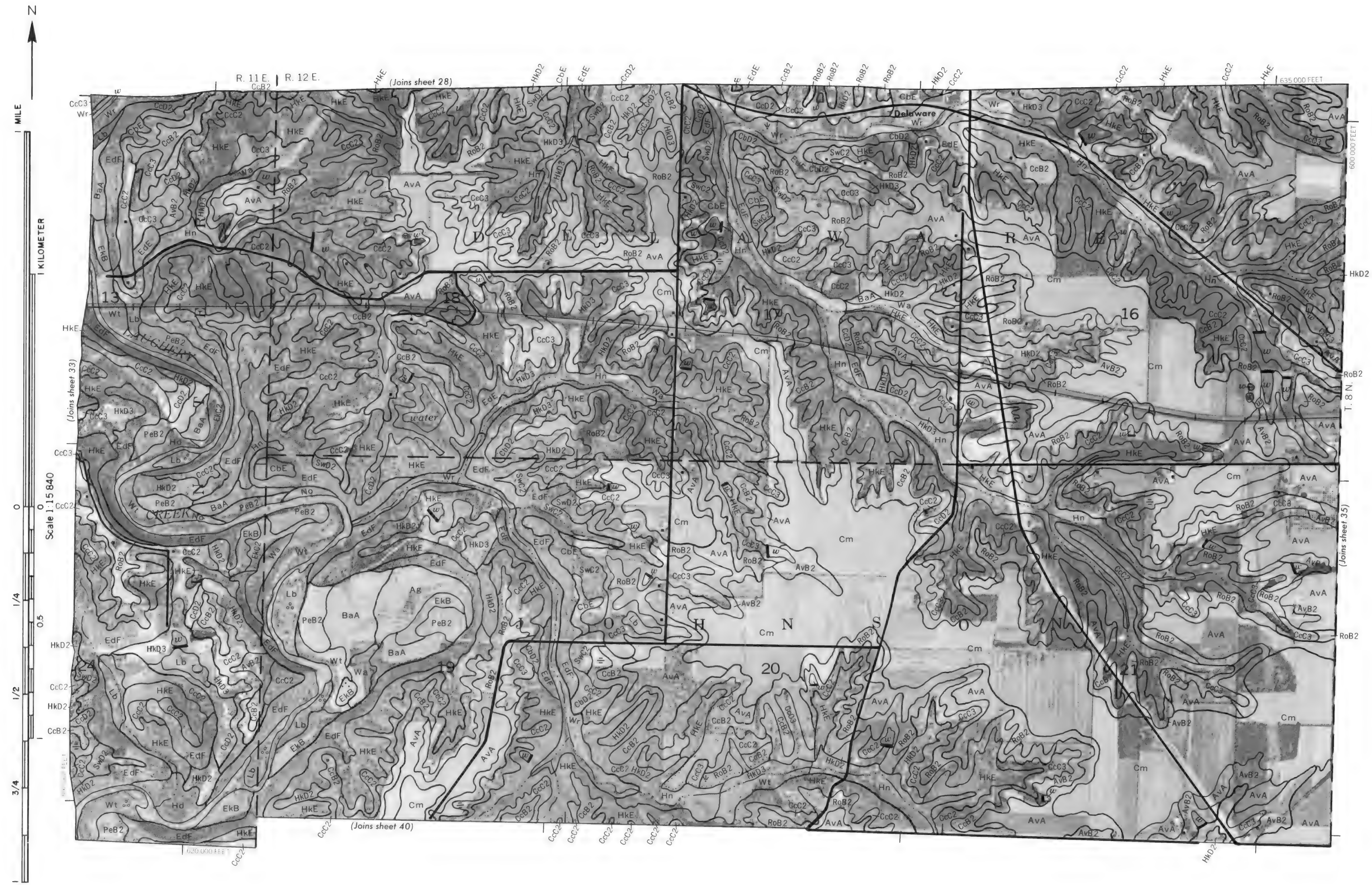


RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 33

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

34

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 34



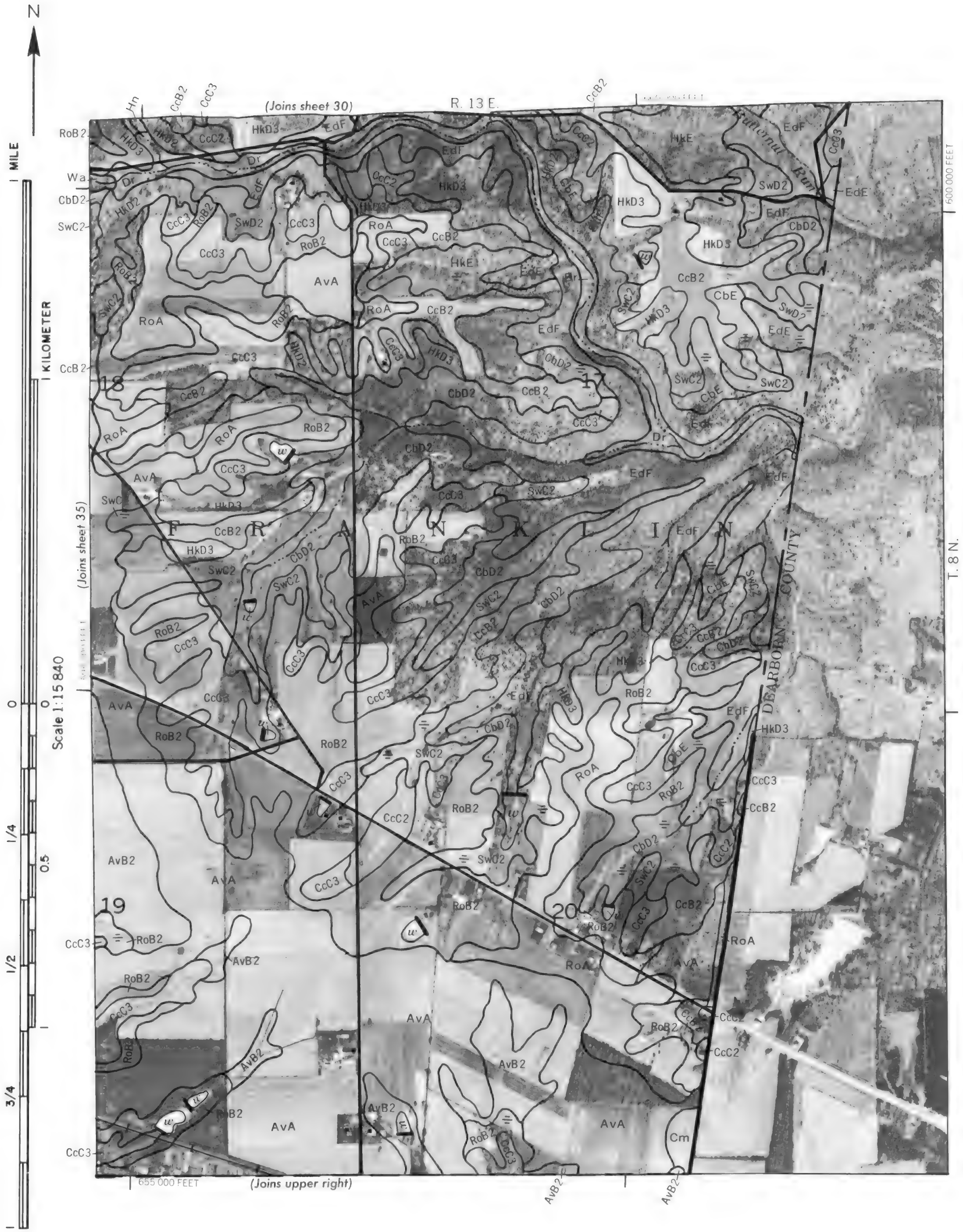
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 34

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 35

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 36



INSET

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

38

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 38

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

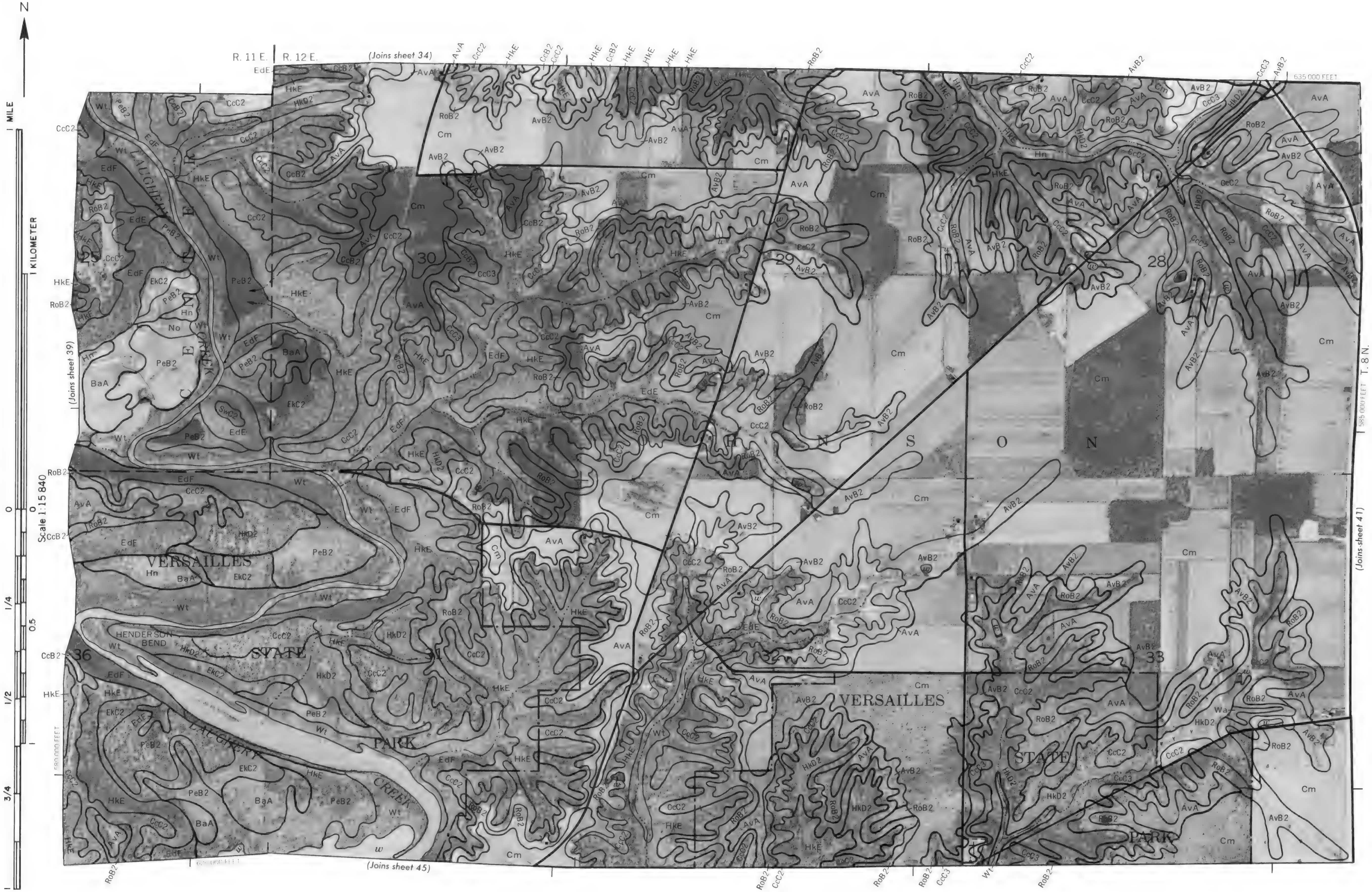
RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 38

39

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 39

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 40



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 41

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 42

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

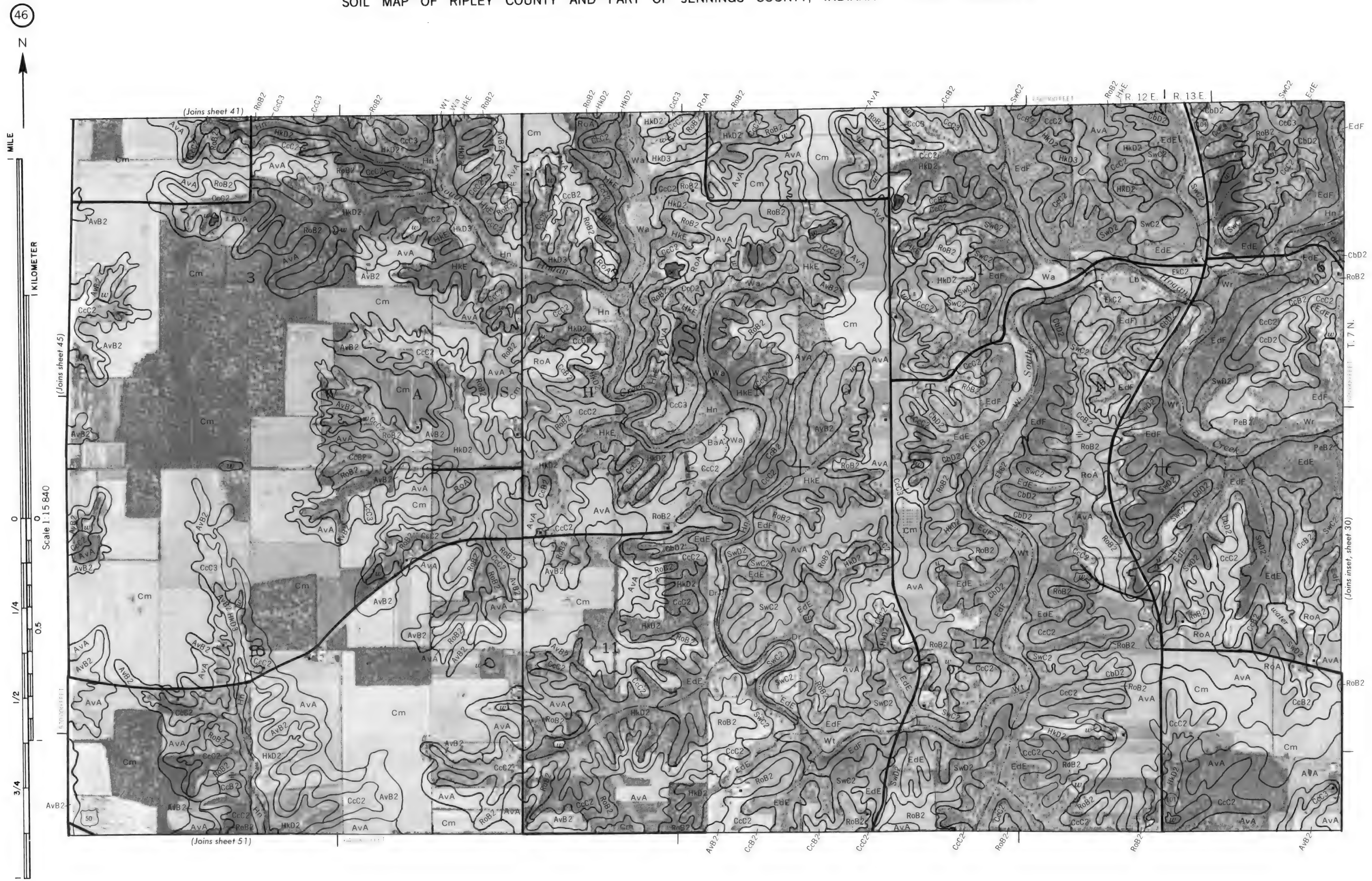
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 44

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 45

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 46



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 46

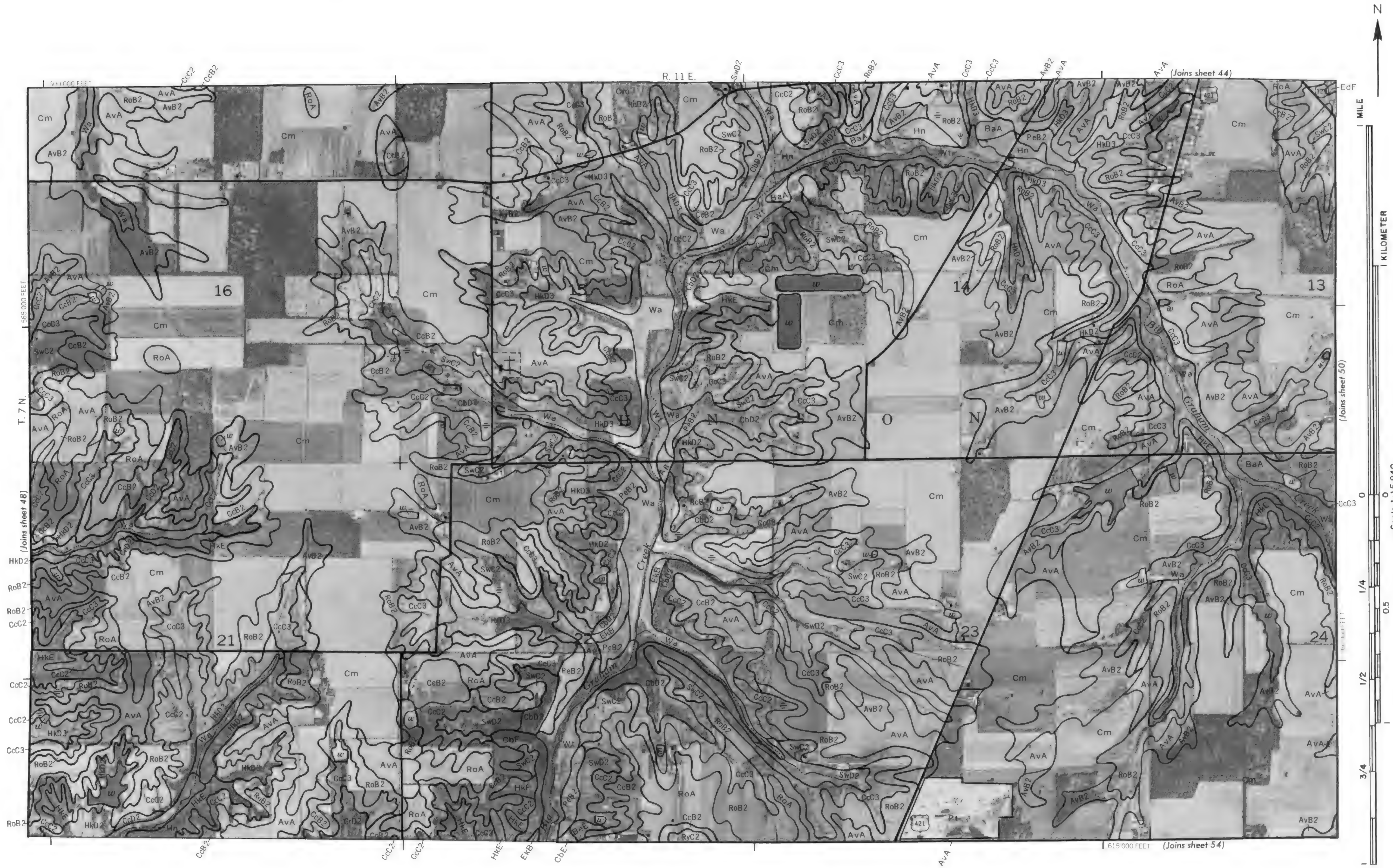
RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 47

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 48

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 48



RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 49

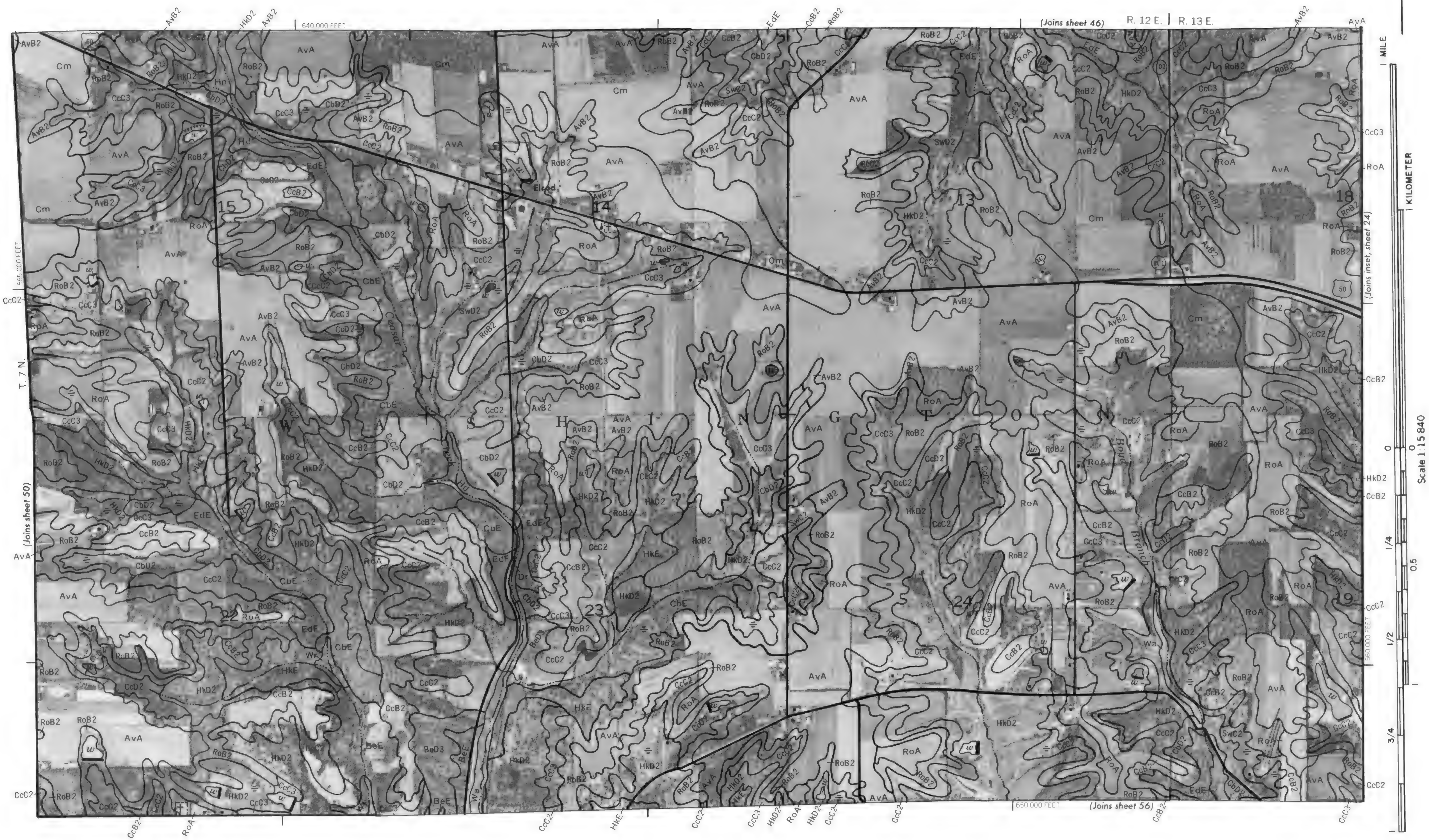
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 50

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 51

51

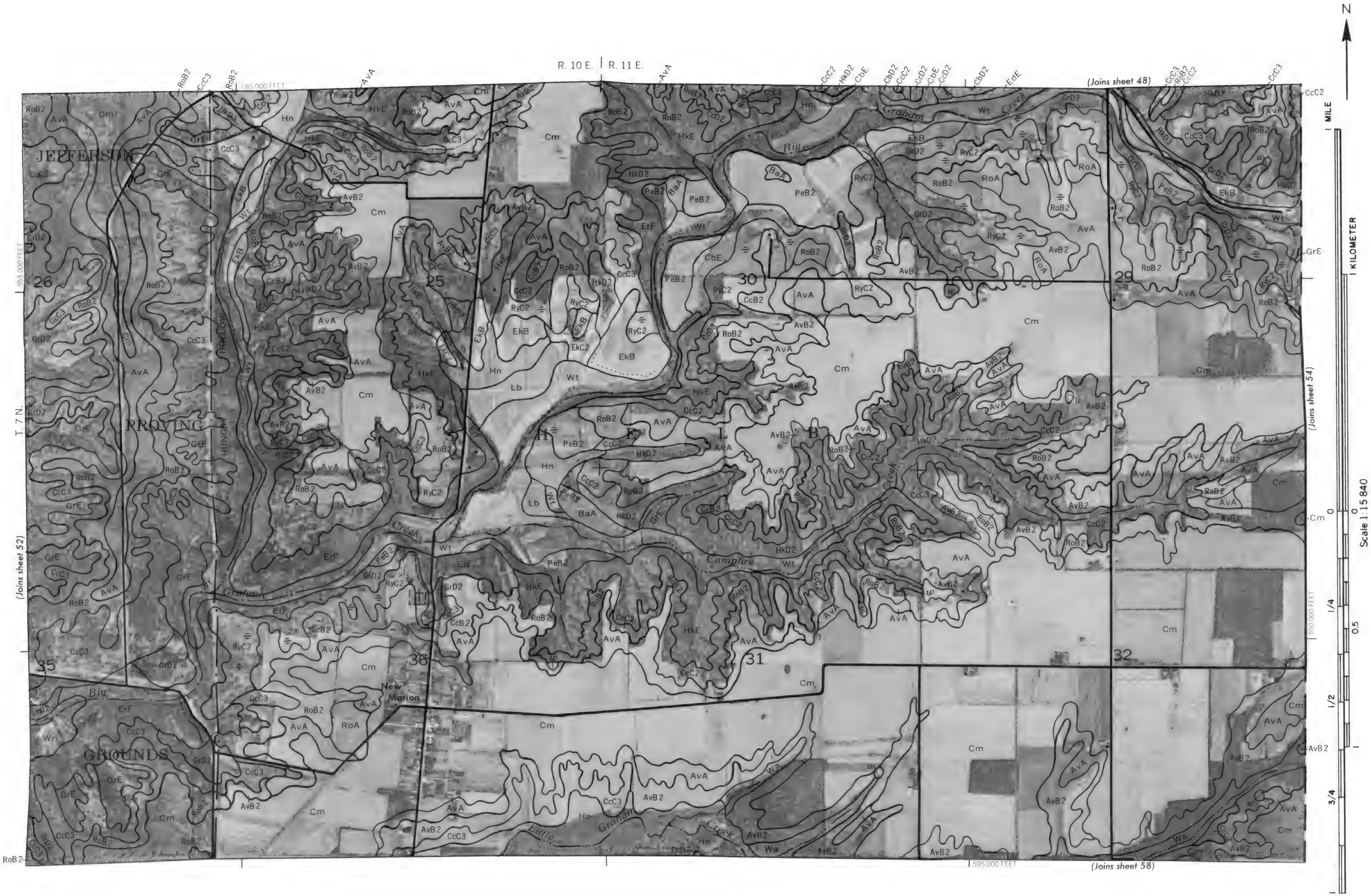


RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 51

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 52

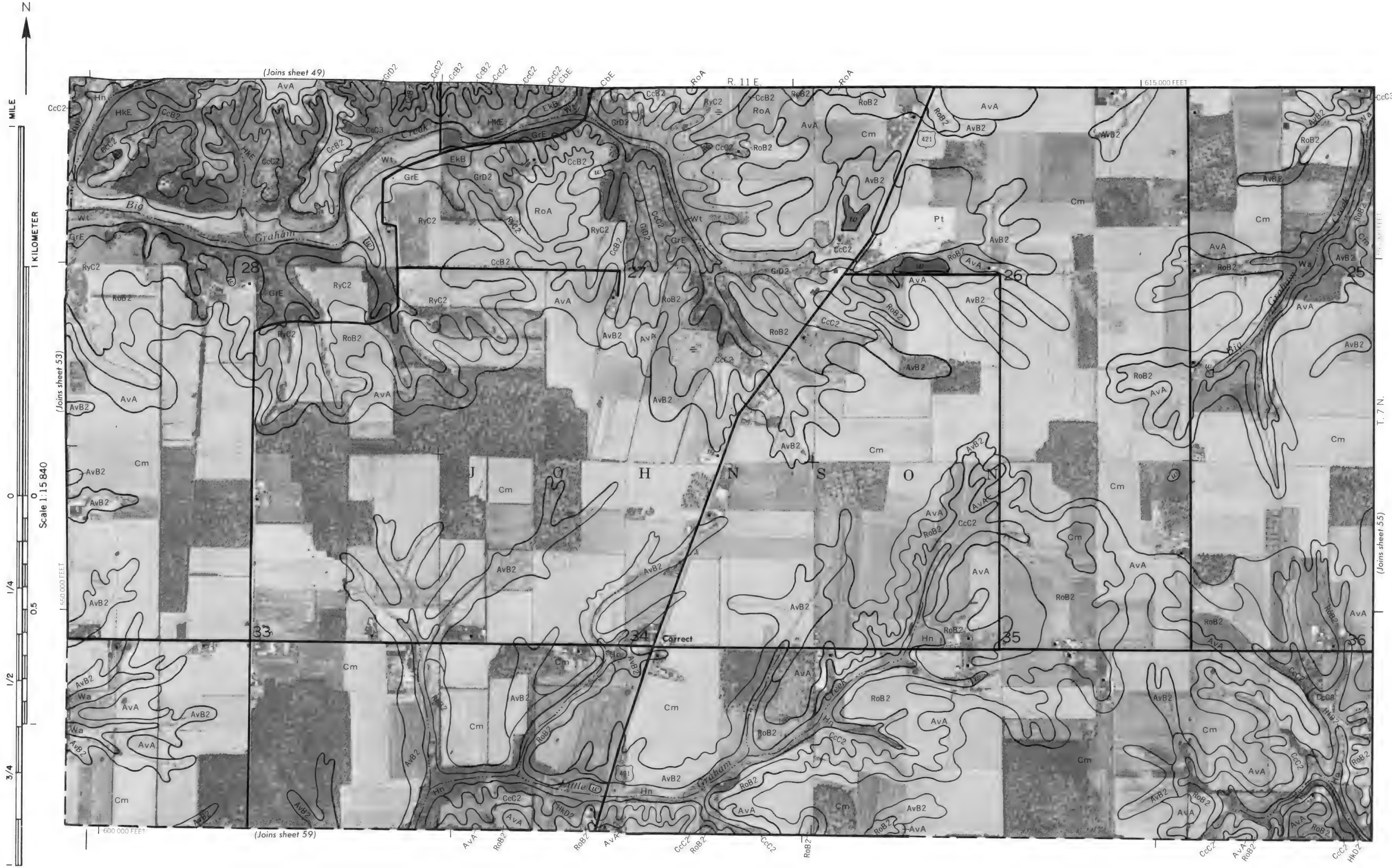
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 53

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 54

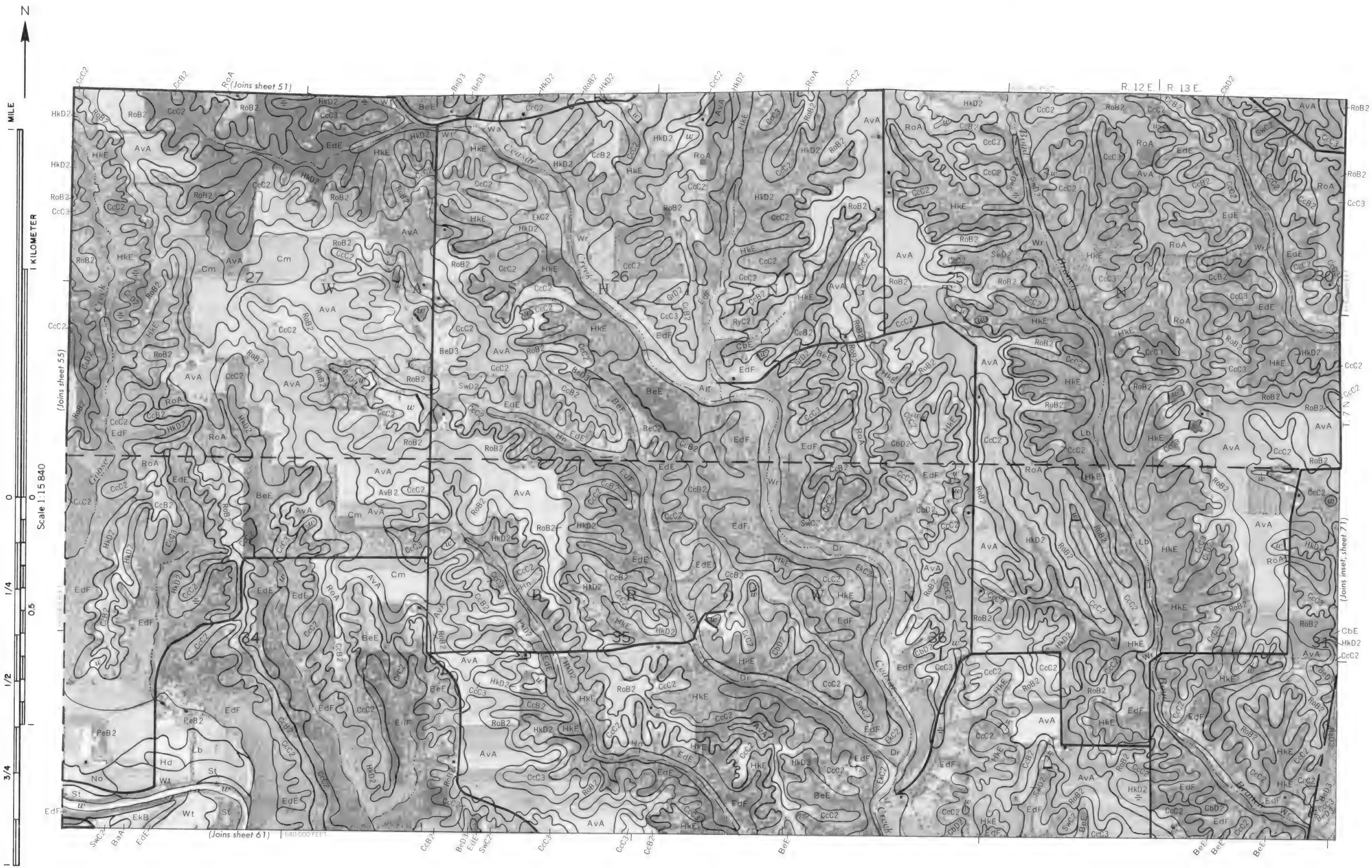


This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 54

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 56



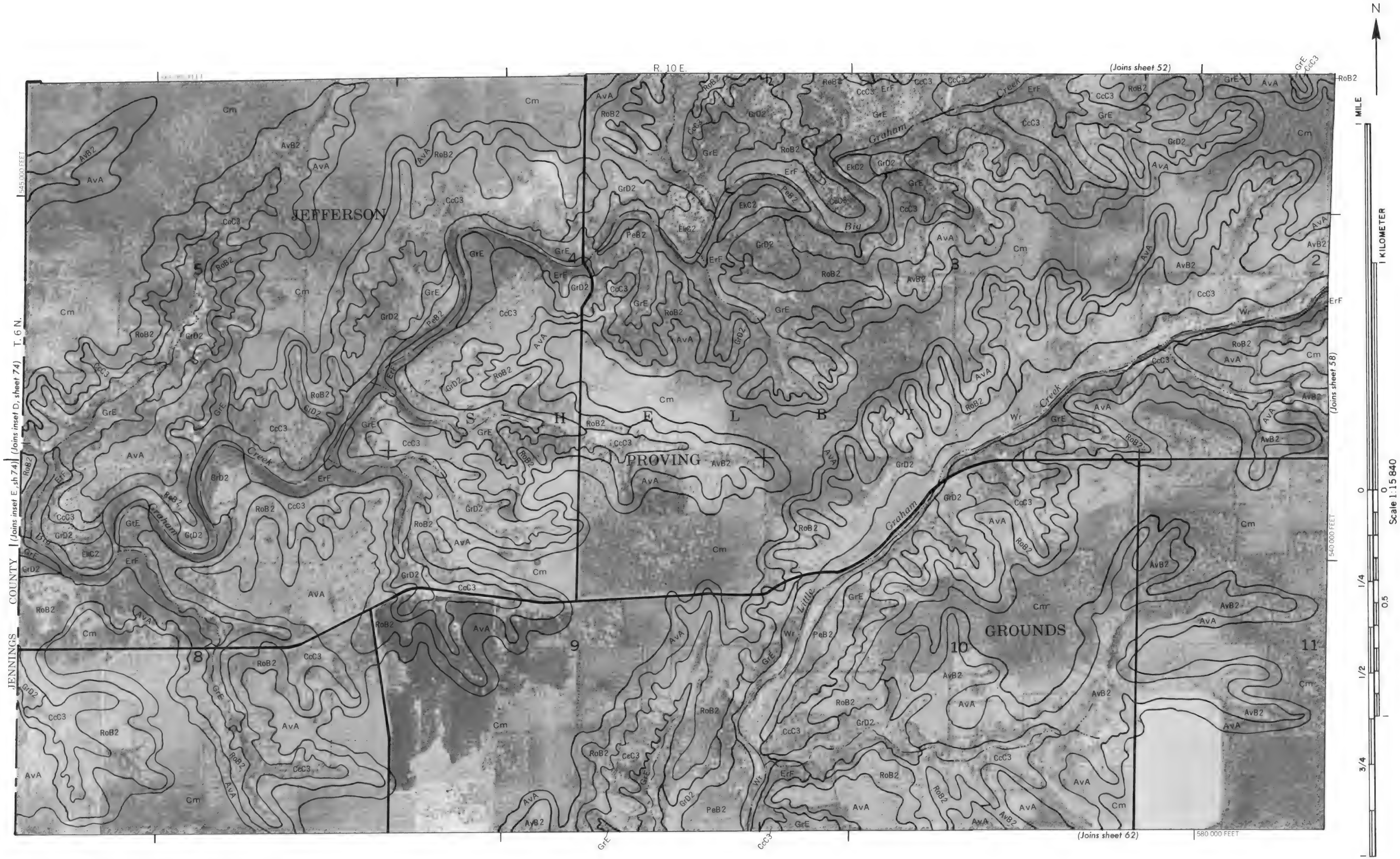
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 57

57

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 57

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

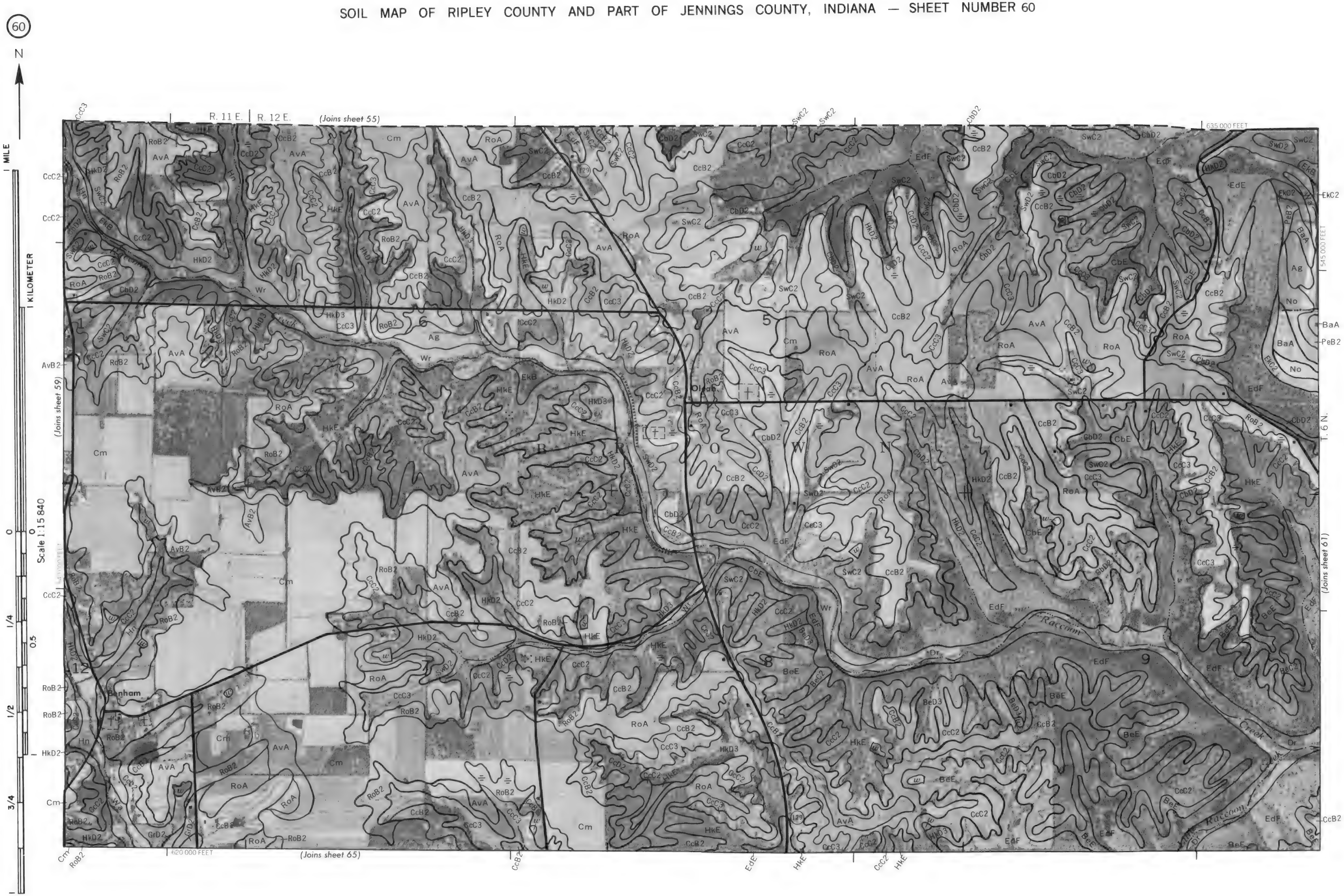


SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 58

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 59

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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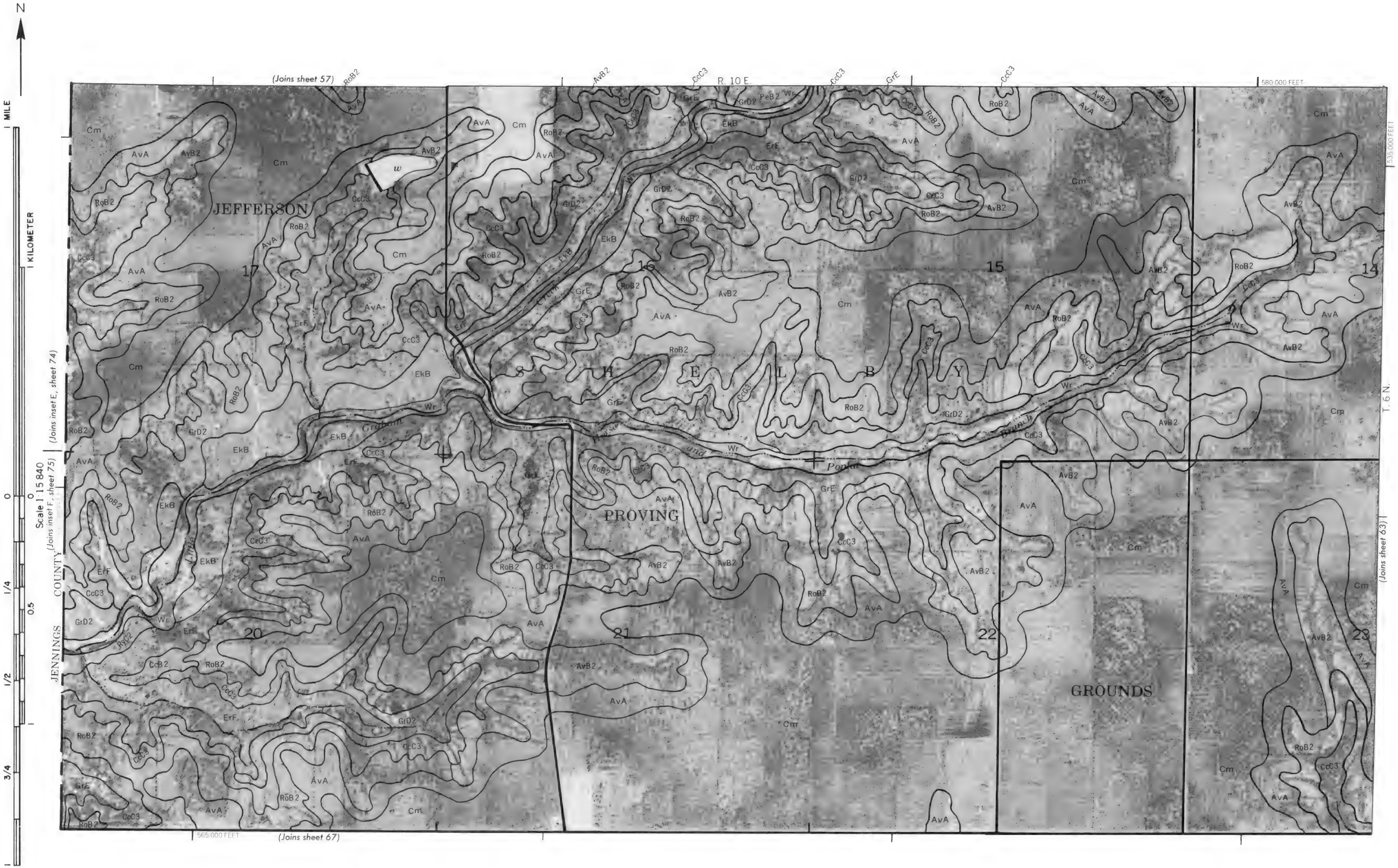
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 62



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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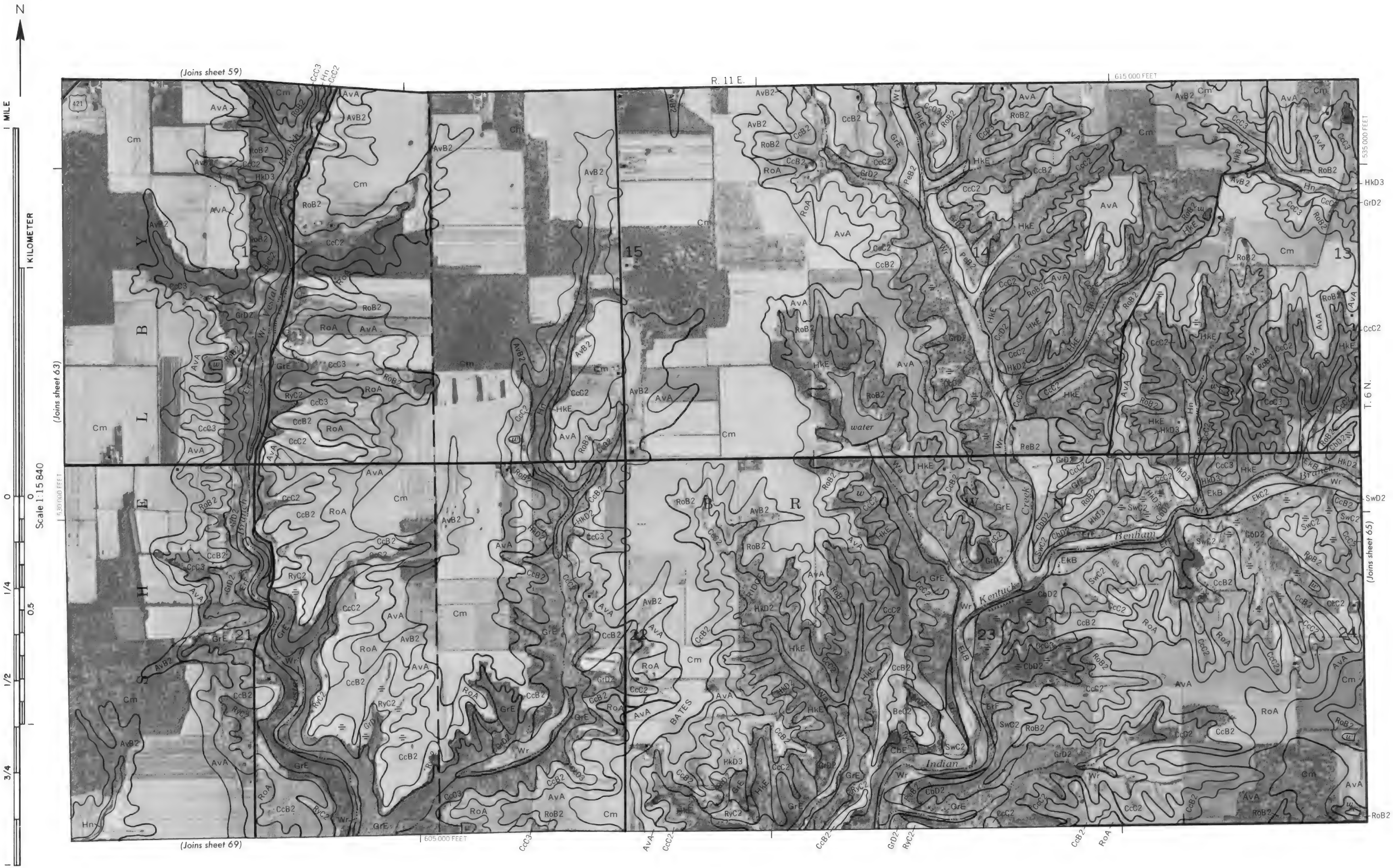
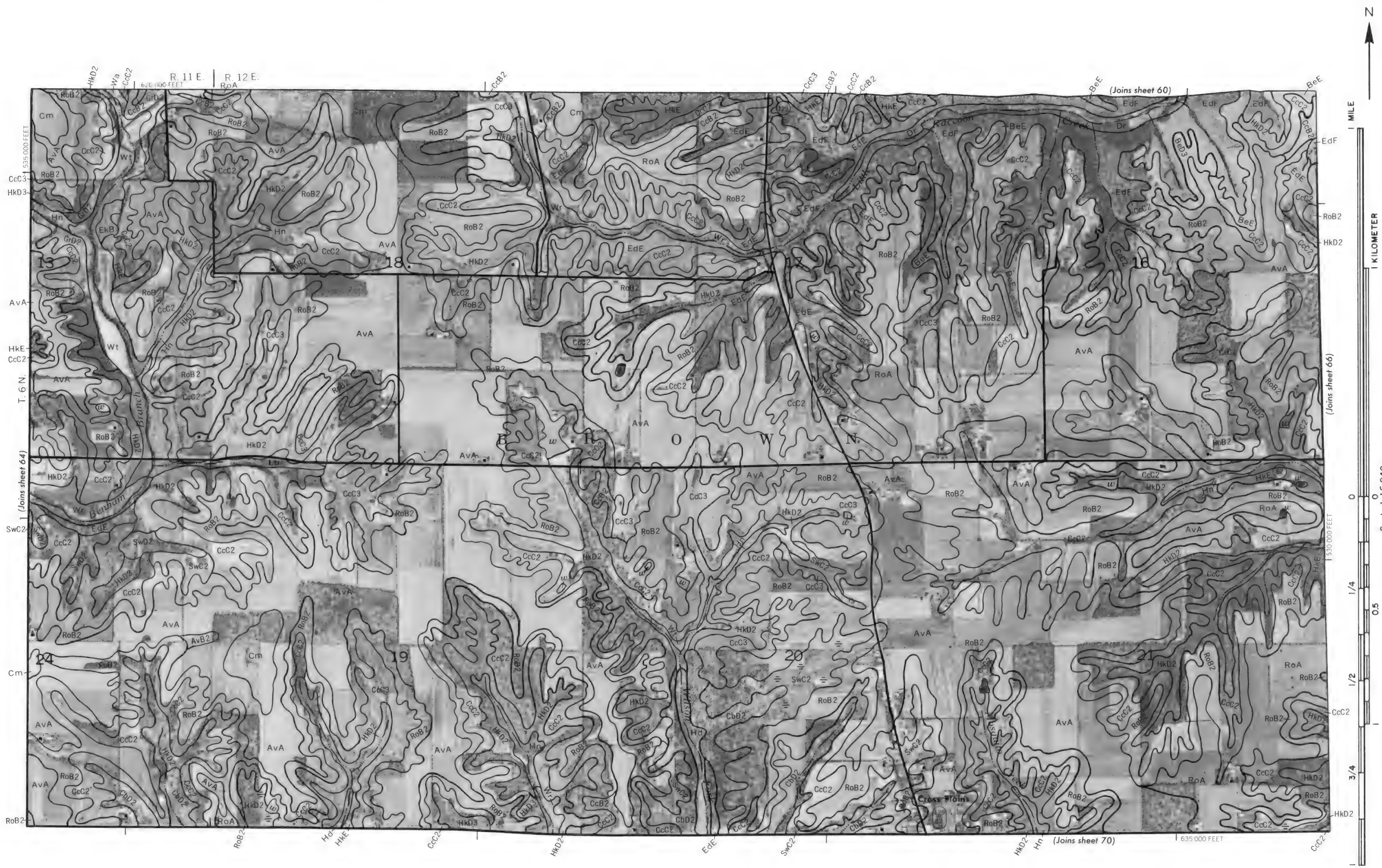
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 64



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 65

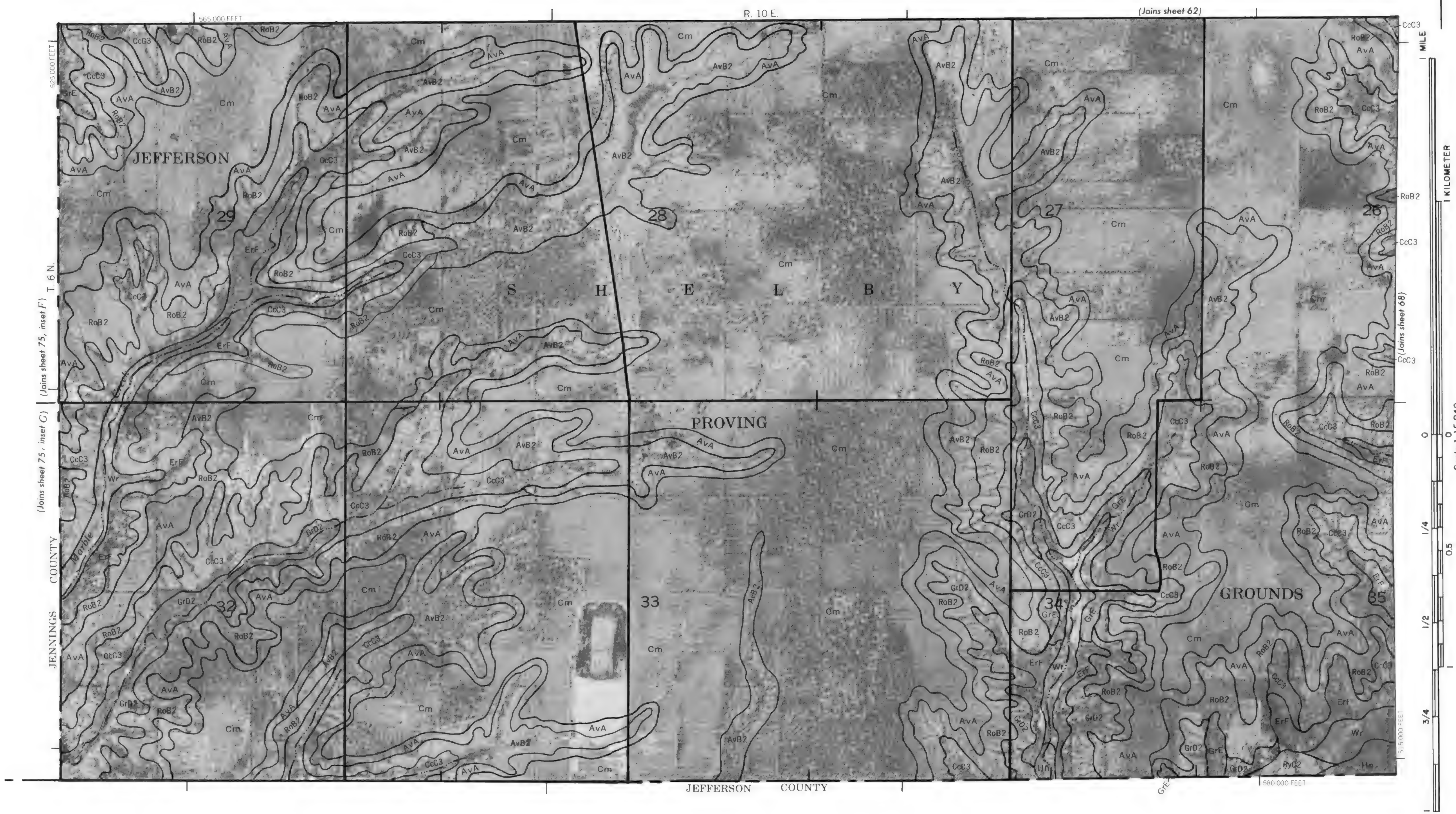
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 66

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 67

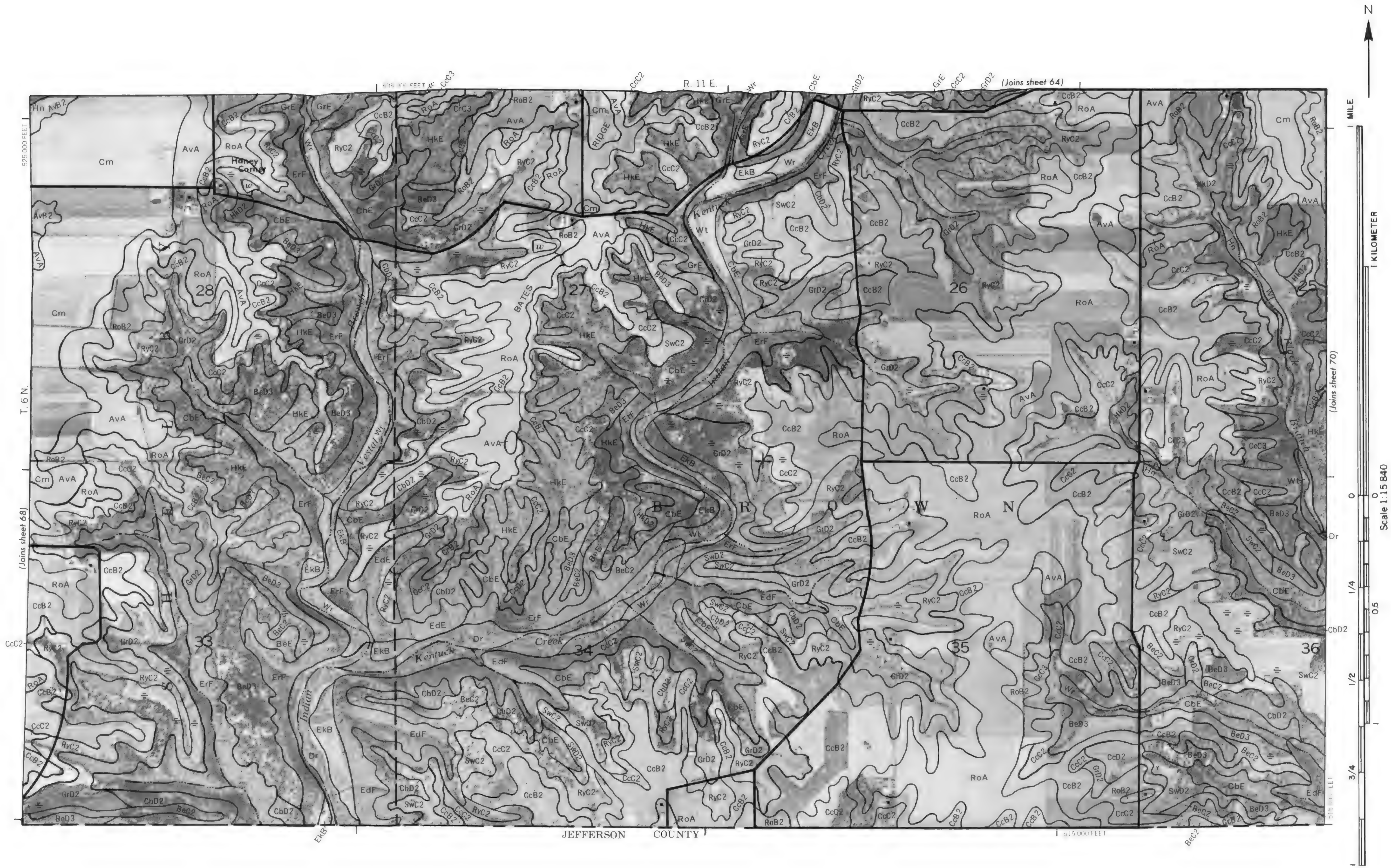
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 68

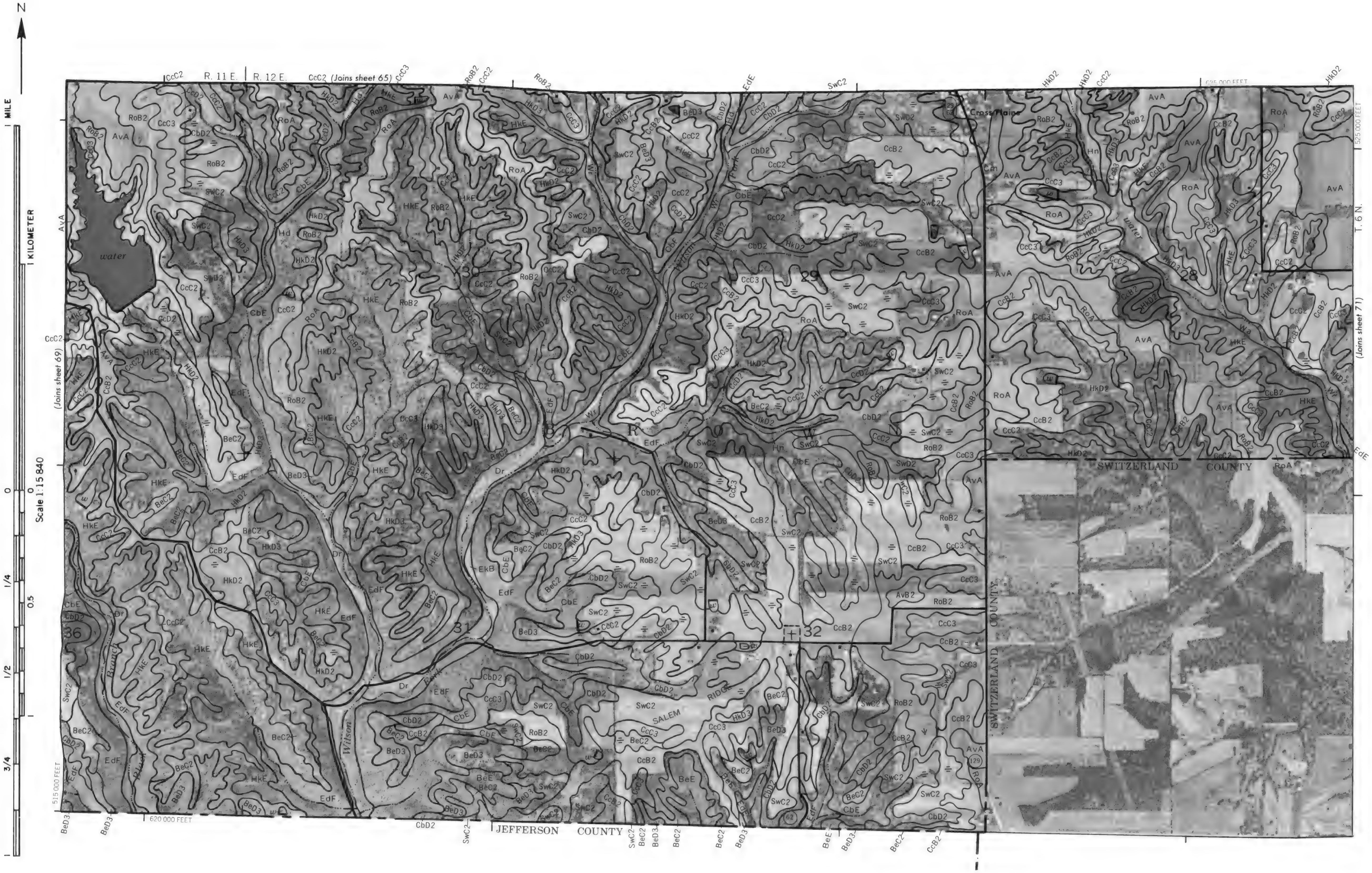
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 68



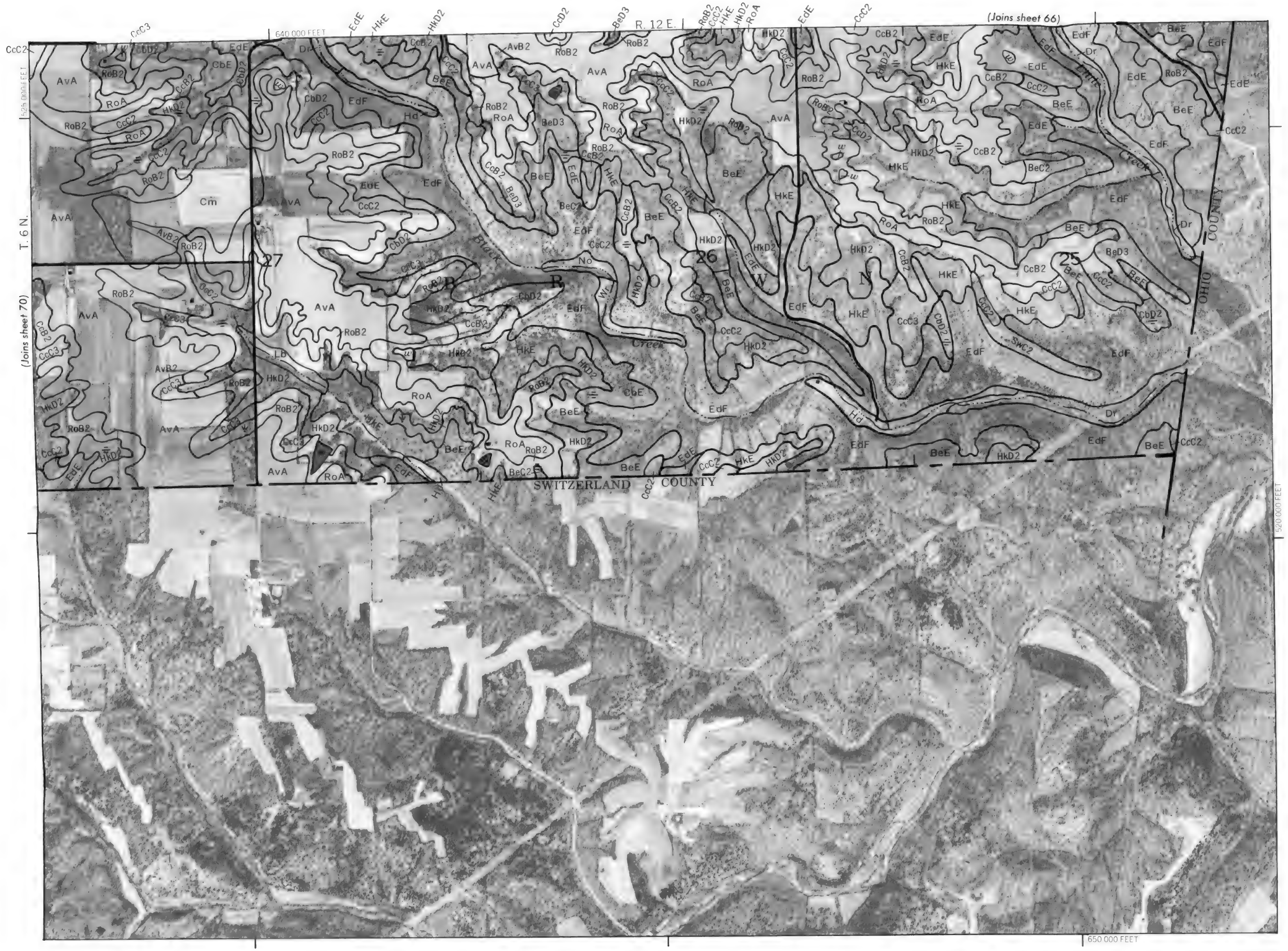
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

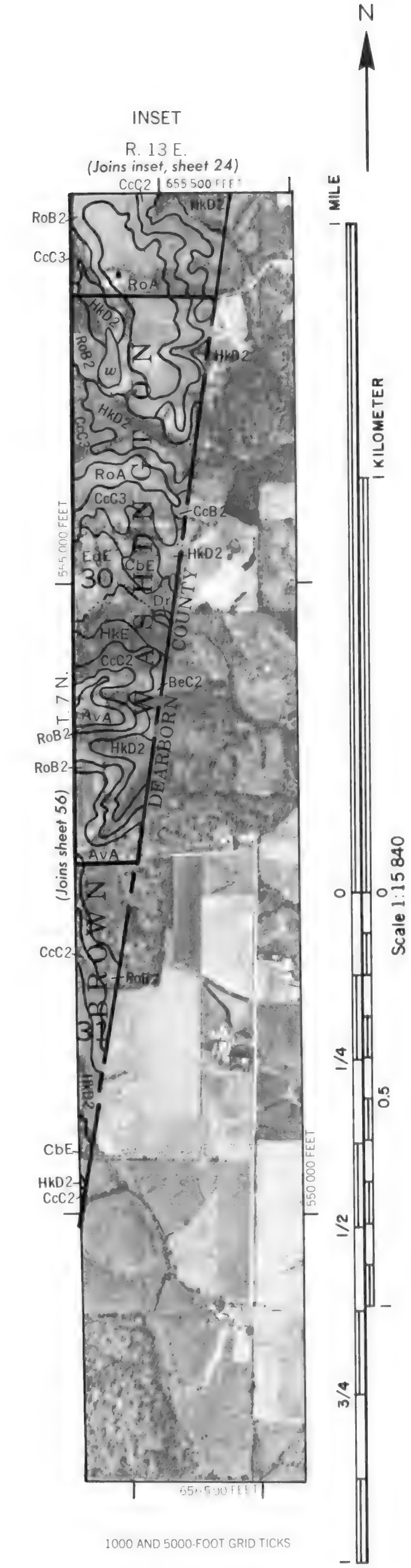
SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 70



This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

71





RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA NO. 71

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 72

N

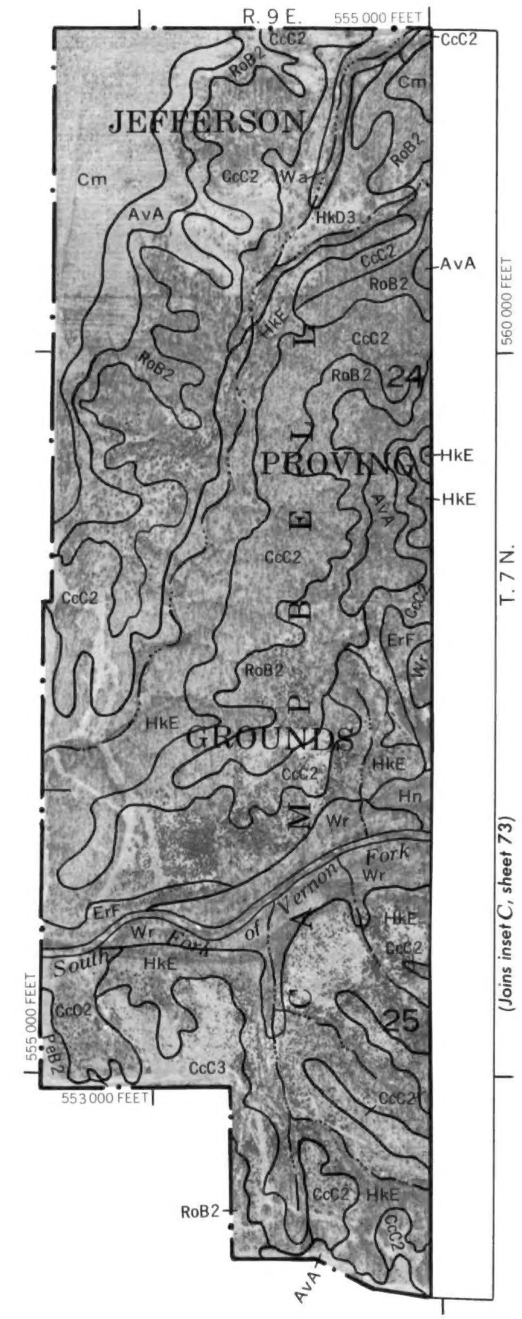
1 MILE

1 KILOMETER

Scale 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1



2000 AND 5000-FOOT GRID TICKS

INSET B

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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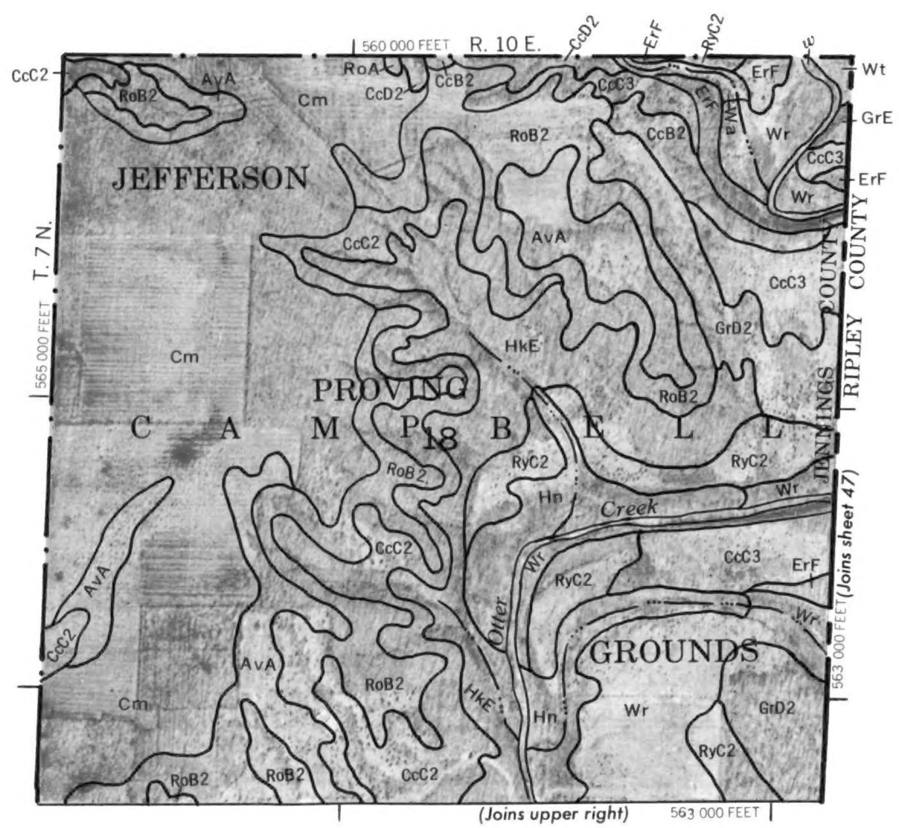
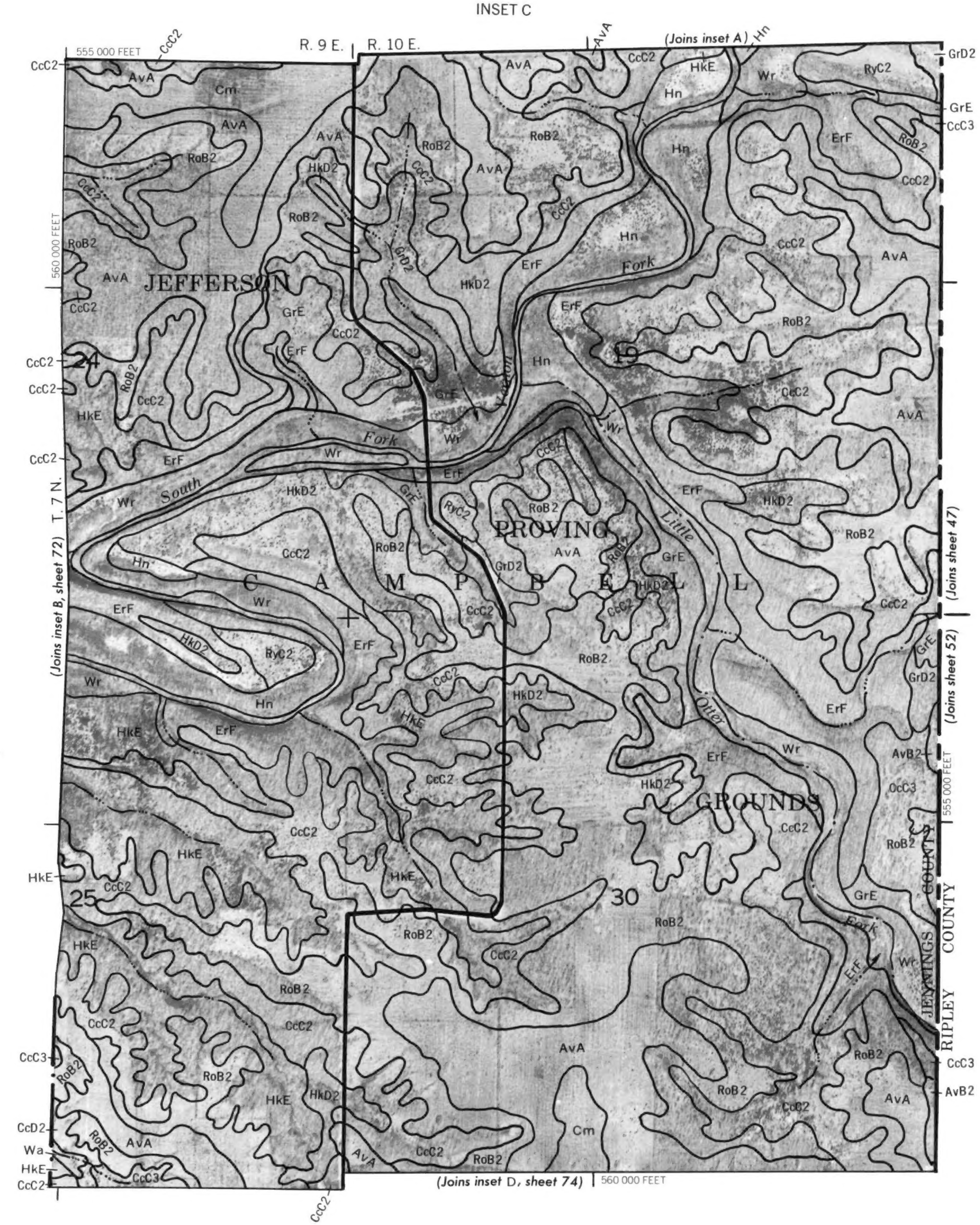
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

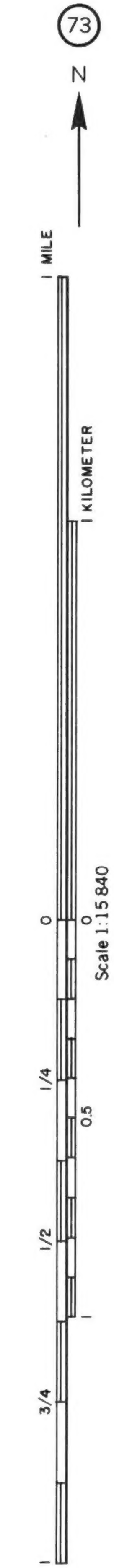
INSET A



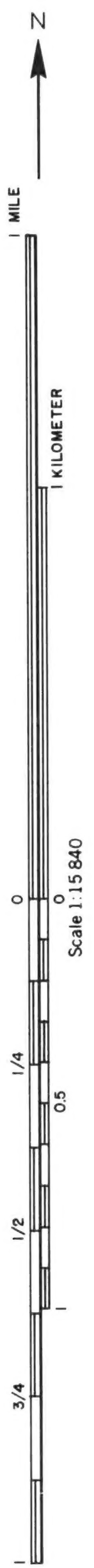
2000 AND 3000-FOOT GRID TICKS

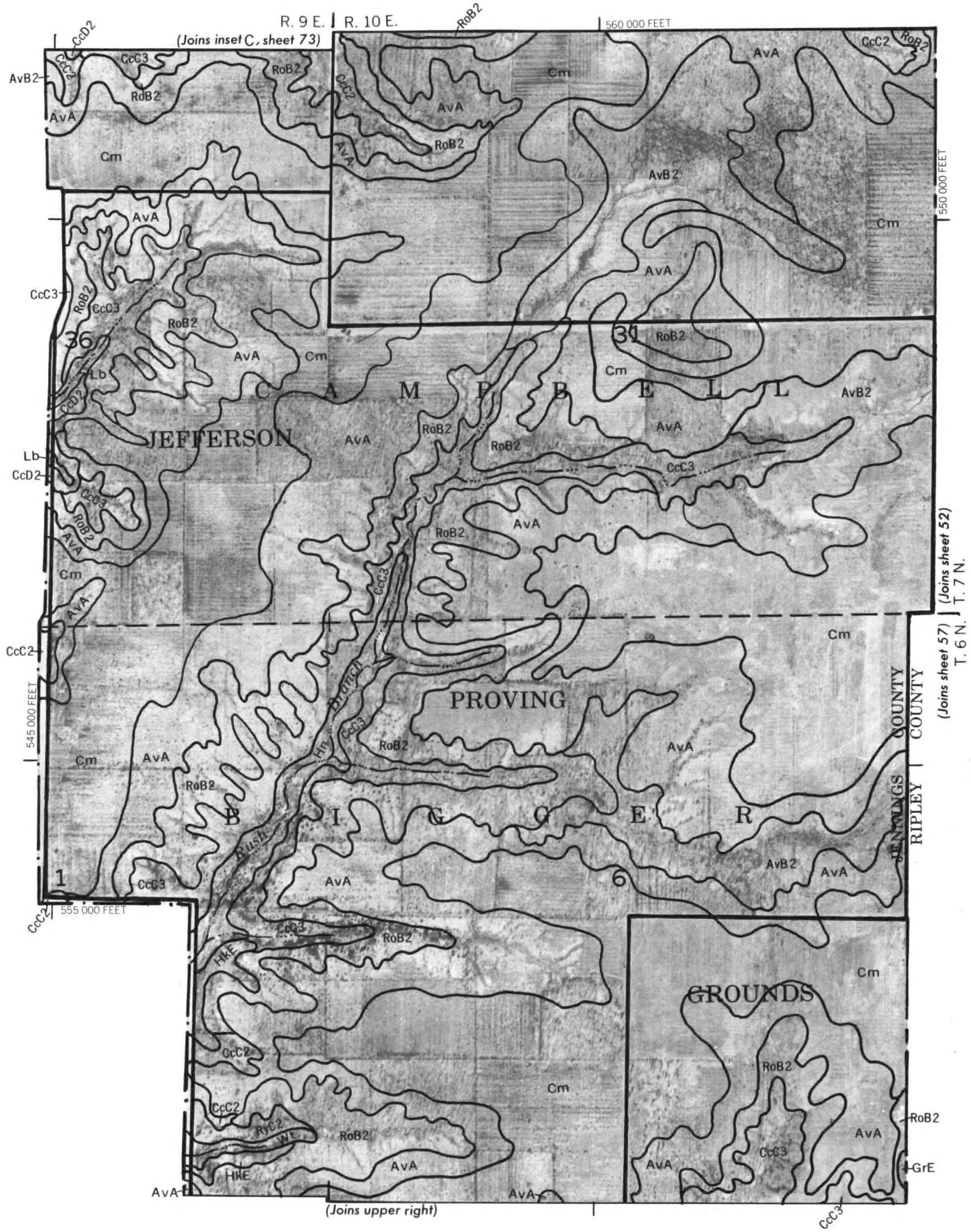
INSET C



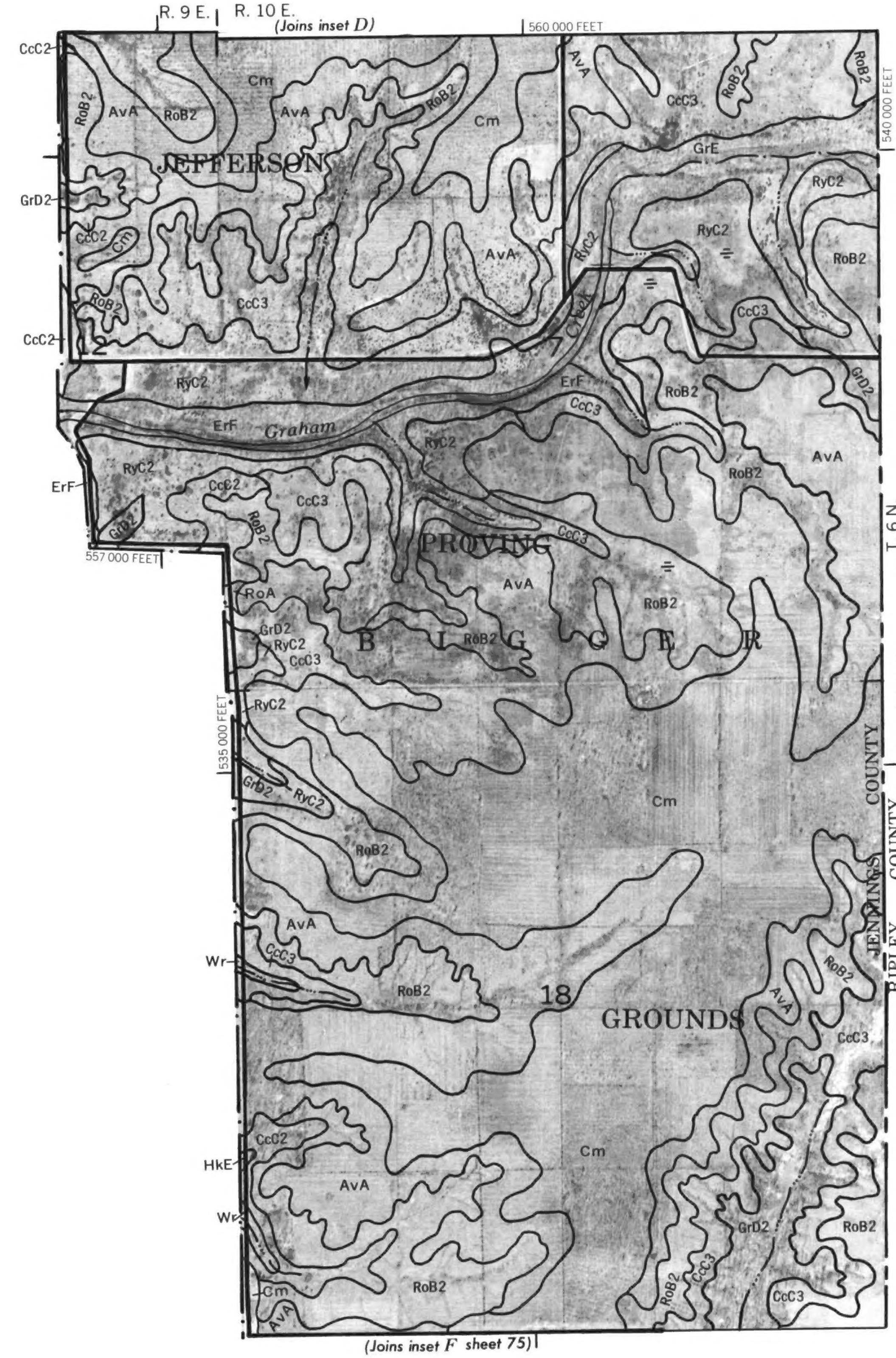


SOIL MAP OF RIPLEY COUNTY AND PART OF JENNINGS COUNTY, INDIANA — SHEET NUMBER 74





INSET D

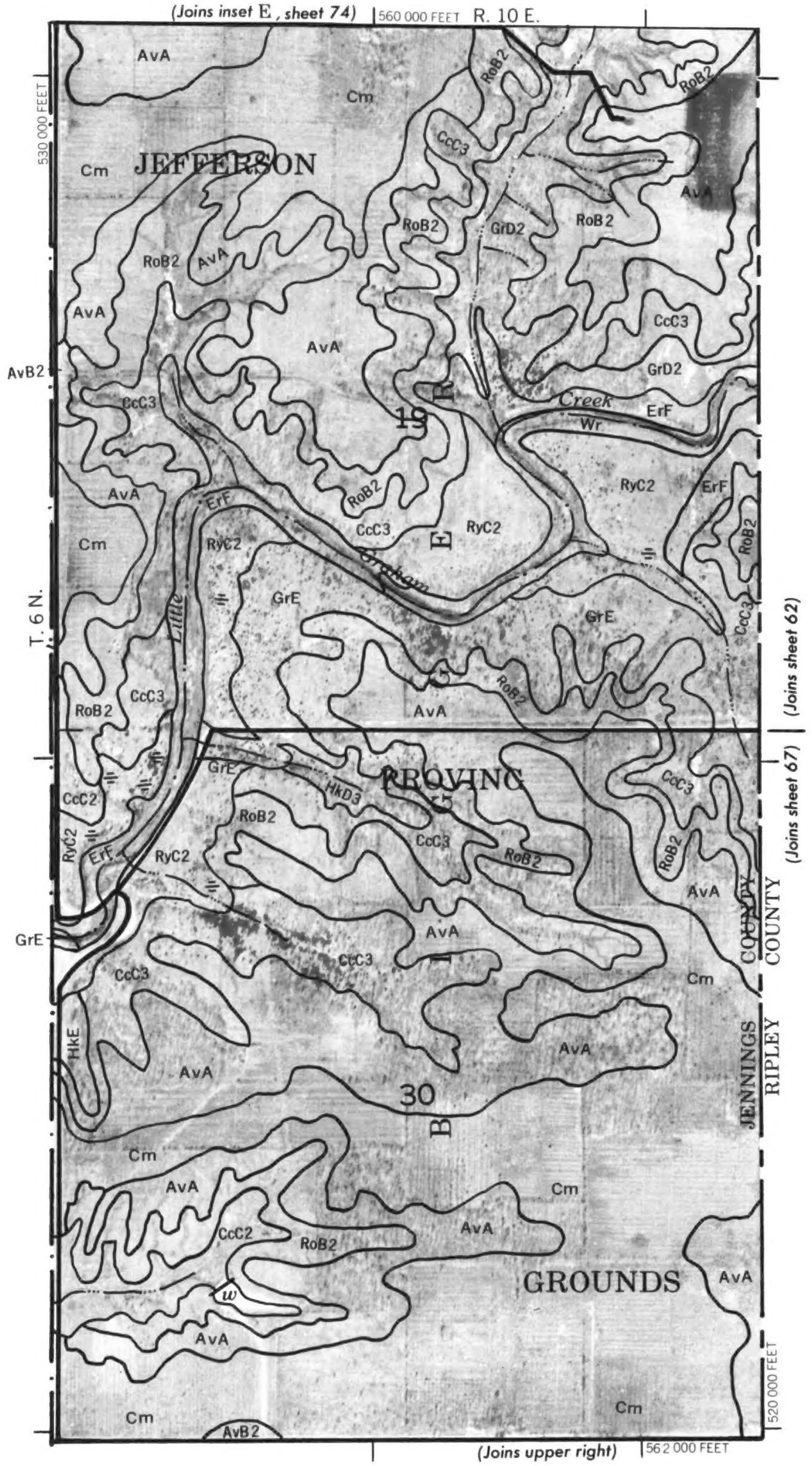


3000 AND 5000-FOOT GRID TICKS

INSET E

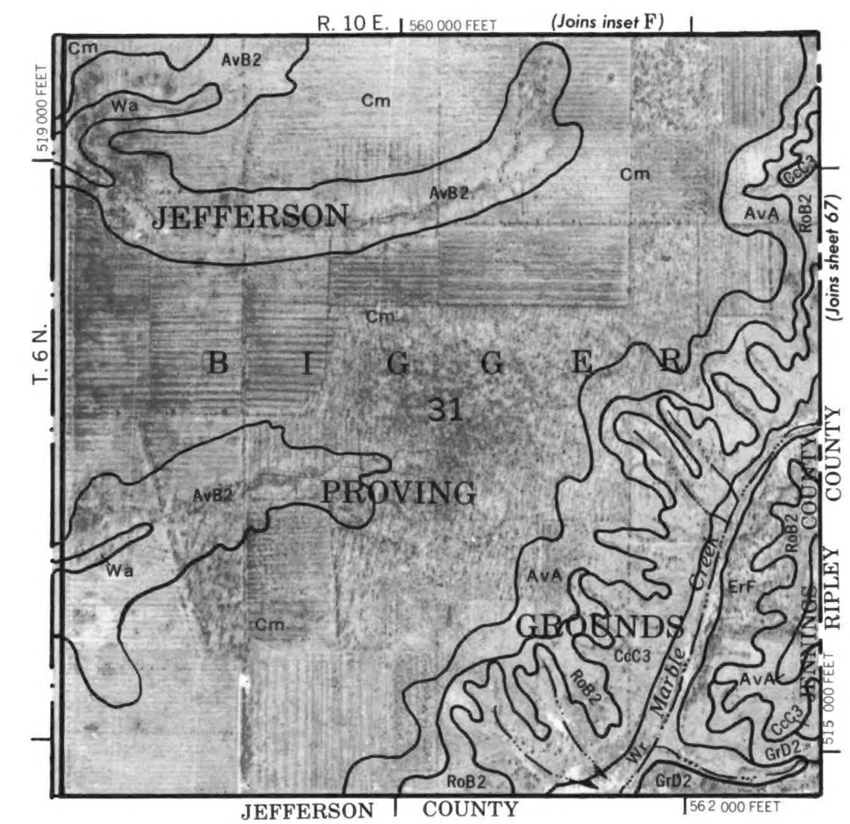
This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



2000 AND 5000-FOOT GRID TICKS

INSET F



2000 AND 4000-FOOT GRID TICKS

INSET G